

MALAYAN FISHERIES

*A handbook prepared for the inaugural meeting of the
Indo-Pacific Council, Singapore, March 1949.*

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FOREWORD

by

THE RIGHT HONOURABLE MALCOLM MACDONALD

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FOREWORD.

This manual is designed to fulfil three purposes, which are explained later in the foreword. It is prepared especially for those who are concerned in the Conference. We hope however that it will reach the hands of others without the experience and knowledge of Fisheries which delegates bring with them. Thus it may be well to launch it with the statement of certain fundamental truths.

The first is that the development of Fisheries is a matter of extreme importance to the area with which we are dealing. Rice has become the staple diet of the populations of South East Asia, but by itself it lacks the protein content which adequate nutriment requires. The contribution which fish makes to that nutriment is important. It can be very much more so, and indeed it is the intention of this Conference that it will be so.

Until now the problem of taking fish from the seas of South East Asia has not been given concerted attention. Along the seaboard of the South East Asian countries the methods developed throughout many generations are still used. These methods themselves, intelligently evolved, are not by any means ineffective. They are simply limited by the comparative frailty of vessels and equipment when it comes to deep water work. Extension of fishing operations beyond presents limits will necessitate substantial technical changes in the fishing boats and equipment. Again refrigeration is something that has yet to be developed if vessels are to remain for the long spells at sea which deep water exploitation would involve. Just as the benefits of the machine age and modern science are being brought to bear upon problems of agriculture, so they can play their part in the exploitation of the sea.

It is reasonable to suppose that the prospect of the world's new demands for food will be met in a large part from aquatic resources and this possibility has obviously special point for South East Asia.

The old adage that there are as many fish in the sea as ever came out of it, is, like most of its kind, only half true. When the fishing areas receive the full impact of modern technology the resources must not be permitted to diminish. That again is a problem on which scientific investigation and wise administration must be turned. Unlike the land, the sea has no barriers. What is done in one part of the world may have its reactions in many others. This makes world wide collaboration of workers in the fishery fields all the more important. The best method of such collaboration is the exchange of information about programmes of work and an exchange of views on such information. The basic machinery for that exchange of information and views is the regular conference with its secretariat. The Government of the United Kingdom, firm in this

view, has worked hard for the Indo-Pacific Fisheries Council since Lord Killearn convened the Singapore Fisheries Conference of 1947. As a result of that meeting we have had available to us the expert and friendly services of Dr. Kesteven, of the Fisheries Division of the Food and Agriculture Organization of the United Nations.

I have referred to the three purposes for which this hand book is offered to the conference. The first is to explain the developments which have led up to the meeting. The second is to set out in concise form an account of the fishing industry of which the visitors will see something during their stay in Singapore. Thirdly, we hope that it will at least make a small contribution to the Council's discussions.

We are ourselves indebted to a number of individuals who have helped in its compilation and on whose knowledge we have happily been able to draw. Among them are:

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Mr. Tham Akow, Research Officer, Fisheries Department.

Walter M. MacDonald

*Commissioner General for the
United Kingdom in South East Asia*

Introduction.

The devastation spread by the war over many of the territories of South East Asia had particular effect on the primary industries, which was not unexpected in view of the economic organisation of the territories, but it was, for that very reason, all the more important. Agriculture was disorganised, with its irrigation systems destroyed or left unrepaired, its implements destroyed or worn out, and its livestock slaughtered. In the fishing industry boats were sunk or damaged and nets and other gear perished and became scarce, for there were no replacements. With the blowing up of bridges and harbour installations and the removal of ships and rolling stock for the uses of war, normal distribution ceased. Of even greater importance to all industries, men were forcibly recruited in thousands to build strategic roads and railways, and for other war purposes; many of them never to return.

The situation arising out of this devastation was aggravated by the removal of Japanese operations* from the scene. For the fishing industry this was very important because before the war fishing fleets from Japan had operated in many areas in South East Asia, including the Philippines, Borneo and Malaya. They had operated widely and with energy, and had employed techniques and equipment which enabled them both to catch more fish in existing fishing grounds and to operate in waters generally neglected by the local fishermen. These operations were interrupted by the war and ceased entirely with the end of hostilities. This meant the withdrawal of a quite substantial supply of food.

For these reasons food production fell very seriously and distribution became difficult or impossible and the spectre of famine arose in many of the South East Asian lands. Urgent efforts for the restoration of food supplies were called for and whilst, obviously, each territory would expend every possible effort to this end, outside help was necessary. Two international projects directed attention, supplies and help to these problems.

The Allied Nations, acutely aware of the problems which had arisen because of the war, and which it was known would be accentuated at the end of hostilities, recognised that there would be need for relief measures and to meet this need founded the United Nations Relief and Rehabilitation Administration, known as UNRRA. The primary task of this organisation was relief but it was also charged with measures to secure the economic restoration of the countries where it operated in order to enable them to provide for their own continued welfare. In these programmes, which operated in two broad regions, Europe and Asia, fisheries received early attention. In the Asiatic

area a large and ambitious programme was formulated for China, and is still in course of implementation;* a survey was made of conditions in the Philippines and recommendations submitted; arising out of the experience in the Philippines a recommendation was made by the South West Pacific Area (Sydney) office of UNRRA (from which the Philippines Mission was at that time staffed) that the fisheries experts of the SWPA should meet to consider measures for international collaboration in the onerous task of restoring the fisheries of this area.

In May 1946 an informal conference was held in Sydney by the UNRRA fisheries staff under the chairmanship of Mr. G. C. Remington. The scope and functions of international collaboration for administration, development and research were debated in many aspects. It was recommended in the report of this conference that a larger conference, more representative of the governments of the Far East, should be held.

The British Government, early in 1946, had considered international collaboration necessary for the rehabilitation of the territories of South East Asia and the Secretary of State for Foreign Affairs appointed a Special Commissioner. Among his directives was:—

“that all possible steps are taken to alleviate the food crisis in in these areas in South East Asia where shortages exist or are likely to arise; and that maximum supplies of all kinds of foodstuffs, including rice, are produced and made available from the producing areas in South East Asia with that maximum efficiency and speed for use both in South East Asia and elsewhere”.

Lord Killearn, the Special Commissioner, arrived in Singapore in March 1946. One of his first actions was to convene monthly meetings in Singapore of Liaison Officers appointed by the governments of all territories concerned.

At these meetings matters concerning the state of nutrition of the peoples of the various territories, the equitable distribution of available foodstuffs, and the means of increasing food supplies were fully discussed.

At the September (1946) meeting a proposal was brought forward to hold a Fisheries Conference. The Liaison Officers, being unanimously in favour of this, agreed to put the matter to their Governments, and to recommend that delegates to the conference should be appointed.

The Agenda, which was drafted with the assistance of Mr. D. W. Le Mare, the Director of Fisheries of Malaya, made special reference to the immediate restoration of the fisheries of South East Asia, by such measures as the repair and building of boats, the procurement of tackle, the restoration of processing, transport and marketing facilities and the establishment of schools for training in more up to date methods of fishing.

* 1947

The fisheries experts of the territories were asked to submit papers on the various items of the agenda, to be circulated well in advance of the Conference, in order that the delegates could arrive prepared for the discussions. In all, a total of fourteen papers was received from Hongkong, the N.E.I., Siam and Malaya, and duly circulated.

The Conference was held in Singapore on the 6th, 7th and 8th of January.

Lord Killearn was unable to attend because of illness. His message to the Conference was read by the Minister (Economic), Mr. C. Empson, who welcomed the delegates on his behalf.

The Conference proved a considerable success, thoroughly justifying the trouble which it involved, but attention may properly be directed here to certain salient points which emerged. Naturally the first question was: where could the urgently needed supplies be found? It was made quite clear that deficiencies of netting, twine and other materials were seriously hindering the proper and full operation of the industry; there was much discussion of the ways in which these difficulties might be overcome. Although, obviously, no machinery could be set up to deal with this difficult matter, lines of action, which might be independently followed, were disclosed. During these discussions it became apparent that the problems of rehabilitation were inextricably mixed with those of re-orientation and development of the industry. There was confirmation of this view during the subsequent discussions on training, on the introduction of western methods of operation and of certain Japanese methods, on assistance to the fishermen in respect of their financial problems, and on other matters. It would appear that the processes of change in the fishing industry began as a result of the impact of western technology on Asiatic economy, and were augmented by the presence of the Japanese, who employed a modified western technique; these processes have been accelerated by the results of war. The deficiencies of equipment, caused by the war, have set up demands not only for direct renewal but, very strongly, for replacement by different equipment of greater efficiency in every respect. In effect there has been an acceleration of the pre-war tendencies. But these processes of change do not take place smoothly; all manner of technical, financial and administrative problems have arisen. Successful consummation of these processes will require from the operatives, the administrators and the researchers, a considerable amount of patience and ingenuity. This thesis was briefly touched upon in the Fisheries Conference and leads logically to the major result of the Conference, namely, the recommendation that there should be active international collaboration in this field. It is fairly obvious that in the present situation, with the extremely heavy and growing demands for technical assistance of many kinds, the personnel at present available for such work will be unable to meet these demands. The only solution to this is the

development of collaborative programmes which will permit economies of effort and expenditure, and add efficiency. Moreover it has been found that collaboration of this type has had many advantages in other parts of the world. These views were advanced at the Conference and a specific resolution was made on the subject; incorporated in that resolution was support for a programme for international collaboration modified from a programme drawn up at the Sydney Conference.

The great need was for a Fisheries Expert, to be appointed by the Food and Agricultural Organisation of the United Nations, to work in this region for international co-operation and to bring about the formation of an Eastern Fisheries Council. After some delay G. L. Kesteven, D. Sc. of C.S.I.R. Cronulla Australia was appointed and arrived in Singapore in August 1947.

Lucius Nicholls, C.M.G., M.D.

Chairman of the Fisheries Conference
held in Singapore on 7th to 9th January 1947.

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PART. I

Background Material.

The holding of the inaugural meeting of the Indo-Pacific Fisheries Council is the culmination of prolonged effort by numerous people who have held that an international fisheries council was the best means whereby the task of exploring, investigating and developing the fisheries of this area might be assisted. That this meeting should be the starting point of a fruitful era of collaboration and mutual assistance is the earnest wish of all who have observed these developments.

Within the Indo-Pacific Area itself, these efforts to develop international collaboration had significant manifestation in three important meetings. The principal results of these meetings are summarised in the notes which follow and which are offered in documentation of this history; it is thought that the presentation of these results in this form will be of assistance to the Council in its discussions.

I. The Singapore Meeting, January 1947.

This meeting was convened by Lord Killearn, then Special Commissioner for the United Kingdom in South East Asia. Mr. Charles Empson, Economic Adviser to Lord Killearn, opened the meeting and the Chair was taken by Dr. Lucius Nicholls. The meeting was attended by representatives from Australia, Burma, Ceylon, India, Hongkong, Netherlands, Siam, Singapore and the Federation of Malaya.

AGENDA Item I. The Nutritional Value of Fish: It was recognised that the diets of most of the laboring groups of South East Asian territories were deficient in good quality protein and in calcium, both of which can be adequately supplied by fish. It was estimated that not more than one ounce of fish is available per head of the population daily for the great majority of the peoples of these territories; in India, it was said, the situation was even worse and this emphasised the urgency of the argument that everything possible should be done to rehabilitate the fishing industry after the ravages of war, and to develop it far above the pre-war level.

AGENDA Item II. Fishing Materials in Short Supply: Statements made by the delegates revealed that practically all items of material or equipment were in short supply throughout the area and in view of this the following two resolutions were passed:-

RESOLUTION

No. 1.

COTTON YARN

This Conference views with grave concern the prevailing acute shortage of Cotton Yarn urgently required for the manufacture of fishing nets and tackle in almost all territories of South East Asia and, since this short supply is being reflected in gradually decreasing output of fish in some areas, this conference strongly urges that separate quotas of Cotton Yarn of various counts should be allotted to the territories in South East Asia for fisheries rehabilitation and development, independently of quotas allocated for textiles and other domestic requirements.

RESOLUTION

No. 2.

DIESEL-ENGINES

In view of the urgent need of the Fishing Industry of South East Asia for heavy duty marine internal combustion engines of the diesel or semi-diesel type of 20 to 120 h.p., this conference requests that a high priority be given to the export of such engines to these territories from the manufacturing countries.

AGENDA Item III. **Fishing Methods:** Delegates emphasised that they regarded the native methods as being generally effective within the terms of the existing economy and except for the account and demonstration of the kelong (see below) no further reference was made to native methods, attention being directed upon western methods which might be introduced to these waters.

Bottom Fish-Trawling: Trawling operations in tropical waters were reported as having been generally unsuccessful; it was suggested that the explanation of this lay with the character of the sea-bottom in this area (with its abundance of coral and rock) and the nature of the fish-stocks. India, Malaya, Australia and Ceylon had records of unsuccessful attempts to establish trawling; the Ceylon delegate was able to report recent more successful attempts with a steam-trawler operating on banks to the west of Ceylon. The results of these operations were, to date, most encouraging.

Long-Lining: Successful use of this method off the Mergui Archipelago in water of 40-60 fath. was described.

Surface Fish: It was considered by the Conference that probably the major prospects of fisheries development in the tropics lay with surface fish, and it was therefore urged that particular attention should be paid to the problems of catching such fish.

Purse-seine: This form of gear is used in one form or another in many parts of S.E.A., but is usually hand-operated; introduction of mechanisation would have considerable effect.

Trolling: Reference was made to the possibility of extending the use of this method.

Japanese Fishing Methods: A reprint of a paper on "Japanese Fishing Methods in Tropical Waters", referring to their use of the *Moro ami*, *bacnawa*, *sokobiki-ami*, seine (modified danish), purse-seine, *nagashi-ami* and other methods, was circulated, with a map showing where such methods had been employed in these waters. Interest centred on the *moro-ami*, but the limitations on its use, imposed by the arduous character of the operations, and by the natural requirements of circumstances in which it may be employed, were recognised.

Native Methods—The Kelong Type of Fish-trap: A paper by Tham Akow and D. W. Le Mare, entitled "The Kelong Fishing Method" was presented.

AGENDA Item IV. Methods of Processing: Delegates gave an account of the processing methods employed in their respective countries.

Siam. Sea fish for salting is *pla-thu*, it is salted dry or in brine; dry-salting is employed for fish caught on the west coast of the Gulf of Siam and the product is exported to Hong Kong and Singapore. It is badly packed and deteriorates in transit. Fish for local consumption is split and semi-dried and is a superior product. The freshwater fish *Pla-salid* is dry-salted and semi-dried. Canning had been attempted but costs were high and supplies of raw material and of tin-plate were uncertain.

India. Annual fish production in India was about 224,000 tons of fresh-water fish and 417,000 tons of sea fish; the former costs about twice as much as the latter to produce. Many fish-curing yards have been established (about 160), and these have an annual output of about 68,000 tons. But salt presents a difficulty, chiefly because of the duty imposed on it, and about 160,000 tons of fish are dried outside the yards without salting. Although there was dissatisfaction with the quality of the salt, purification might not receive the approval of the consumers of fish.

N.E.I. Two methods were described:-

A. *Pindang*:- whole fish of *Decapterus*, *Caranx*, and *Clupea* spp. and steaks of *Thynnus* and sharks are steamed in 6% salt-water in earthenware pots which are covered, whilst still hot, with *djati* leaves. Fish treated like this will keep for six months and may be transported. Pots are unglazed and no preservative other than salt is used.

B. In the centre of Borneo the freshwater fish are dried each day, from morning until evening, after having been taken out of the salting-pots; when the fish are three-quarters dry, and at the same time have become heavily infested with fly-larvae, they are

replaced in the pots which are then closed for 12-14 hours. At the end of this time the fish are removed from the pots, the maggots are knocked off and the drying of the fish is continued to completion. Fish treated in this way will last for nine months and does not become fly-infested again, even if the flies have access to it. One kilo of salt is used for 6 kilos of fish, and saltpetre in the proportion of one part in a thousand is added: three kilos of fish will result from this. Very little fish processing is done in Java.

Hong Kong: Fish is brined, salted and sun-dried. For dry-salting fish is split, gills and viscera removed and the fish is buried in tubs of salt for upwards of thirty days; fermentation occurs and there is some pitting of the flesh, but the product finds favor among large sections of the community. There are five canning factories preparing products for export to overseas Chinese.

Ceylon. Dry-salting is widely practised, but brine is never used. Issue of duty-free salt at one rupee per cwt., in 1938, resulted in a reduction in the importation of salt-fish.

Burma. Large quantities of fish are processed. *Saccobranchus* is pickled in salt and packed in Nipa palm leaves for export to the Shan States.

Malayan Union and Singapore. In the main, dry-salting and brining, with subsequent sun-drying. Surpluses are boiled for immediate consumption. The proportion of the catch which is unsuitable for human consumption, because of boniness or other reasons, is used as food for pigs and ducks and also as fertiliser. The use of pressure cooking as a means of softening bones has been practised. Three papers were presented on this subject:

- A. "Fish-salting in Malaya" by Tham Akow.
- B. "Preliminary Study of some of the factors affecting salt penetration in the salting of fish in the tropics" by Tham Ah Kow.
- C. "The Storage of Dried Fish Under Vacuum and Different Gases" by Tham Ah Kow.

In view of the importance of salting and drying as a technique of processing fish in this area it was submitted that salt should be available as freely as possible, and accordingly the following resolution was passed:-

RESOLUTION

No. 3

SALT.

This Conference considers that salt should be available for fish curing at the lowest possible price and should be free from tax or monopoly.

AGENDA Item V. Inland Fisheries: This item of the agenda was very fully documented; five detailed papers were presented and there were discussions of their implications.

Siam. "The Cultivation of Pla-Salid in Siam" by Boon Indrambarya.

India. The Abstract of paper "Pisciculture" by U Khin, the delegate of Burma, was circulated.

N.E.I. A very detailed paper on "The Production of Fresh-water Fish and the Duty of the Extension Service in the Indies" was presented by the N.E.I. Delegation.

Hong Kong. The abstract of a paper, by S. Y. Lin, entitled "Fish Culture in the New Territories of Hong Kong" (published in the Journal of the Hong Kong Fisheries Research Station, Vol. 1 1948) was circulated.

Malaria Control:- It was agreed that every consideration should be given to the question of mosquito control when developing intensive fish culture schemes. Biological control with larviparous fish, strict attention to pond construction and the application of modern insecticides such as D.D.T. and Gammexane should be carefully examined.

Exotic Fish:- It was stated that *Tilapia* had been introduced into Malaya by the Japanese. It is a hardy fish which spreads rapidly, breeds freely and is able to adapt itself to brackish and fresh-water.

On the basis of the foregoing papers the following resolution was passed:

RESOLUTION

No. 4.

FISH-CULTURE.

While it is recommended that efforts be taken to promote the cultivation of suitable indigenous fish in ponds, padi fields and rivers to increase food supply, experience has shown that every precaution should be taken against the haphazard importation of exotic species. Piscicultural activities should be co-ordinated with malaria control measures and irrigation programmes.

... AGENDA Item VI. **Other Marine Products:** The use of marine fish meal for animal food and agricultural fertiliser was discussed. Attention was drawn to the problem of organising the handling of offal. It was resolved:-

RESOLUTION

No. 5.

**FISH BY-PRODUCTS,
FERTILISERS.**

In view of the demand for products with a high nitrogen content the utilisation of fish waste as a fertilizer be given special consideration in the technical development programmes of all fisheries departments.

Attention was also directed to the production of other marine articles of commerce which, it was stated, were a sound source of income and served to improve the lot of fishermen; it was resolved:-

RESOLUTION

No. 6

OTHER FISH BY-PRODUCTS

The Development of Marine Products, not only as articles of food but also as articles of commerce should be given every consideration in the programme of any fisheries department.

AGENDA Item VII. Marketing and Transport: certain aspects of marketing had been dealt with under other items of the agenda. The discussion centred around three points:- A. *Inspection for statistics and control:* collection of statistics in Siam was in process of being established; in the N.E.I. statistical collection is carried out at the markets through which all fish must pass, by law; a similar situation exists in Hong Kong and, on a less complete scale, in Ceylon; attempts were being made to unify the methods of statistical collection in India, and in Australia; the system employed in the Malayan Union was based upon returns obtained from wholesale fish dealers (a sample form was distributed). Reference was made to the availability of a means of check presented by the results of nutrition surveys. The importance of statistical data in the interpretation and understanding of industrial phenomena was emphasised, and it was also urged that uniformity in the method of collection of statistical data was indispensable if any comparisons were to be attempted.

B. *Transport:* The Burmese delegate described the difficult position in which Burma found herself in the matter of transport; high costs of transport made the retail price of fish prohibitive and whilst land transport was slightly improved since military vehicles had been sold to the public, water transport was still difficult; he asked whether the Special Commissioner could assist Burma in the procurement of vessels. The Indian delegate enquired about the availability of blue-prints of suitable types of fishing vessels and it was suggested that these might be available from the Department of Scientific and Industrial Research. The delegate from Ceylon enquired about the availability of vessels from U.S.A.: it was stated that the situation was not easy, and United States prices were high. The delegate from Siam referred to the difficulties encountered by Siamese fishermen in procuring fuel and lubricating oil.

C. *Refrigeration and Ice:* The importance of the availability of supplies of ice in sufficient quantity to deal with current fish production was emphasised. Inadequacy of supplies was reported from Burma (6 tons per day as against pre-war 190 tons), Siam, Hong Kong, India, Malayan Union and Singapore; it was also reported that the price of ice was high: 30Rs. as against 2Rs. pre-war in Burma, \$4.50 per block of 300 lbs. in Hong Kong. Supplies of ammonia and calcium chloride were reported as short in Burma and Siam. The ice position in Batavia was reported as not serious and Australia was stated to have difficulty in connection with ice supply only in handling gluts. In view of the importance attached to the adequacy of ice-supplies, the following resolution was passed:

RESOLUTION

No. 7.

ICE

As this conference is endeavouring to promote the production of fresh fish it recommends the closest co-operation with ice-producers and commercial concerns in order to maintain adequate ice and cold storage facilities of the best type and at the lowest cost.

The following two papers were presented in connection with marketing and distribution:- "The Hong Kong Fisheries Wholesale Marketing Scheme" by J. Cater, "The Entrepot Trade of Singapore" by Tham Akow.

AGENDA Item VIII. The Fishing Community: The Malayan delegates described the Fisheries School which was conducted by the Government of Malaya before the war. Twenty sons of fishermen were enrolled and began by making nets of the kind used by their fathers; they were then taken to sea and trained in the use of the nets. They specialised in the use of drift nets, purse seines and long lines and worked from a powered vessel on which they also learnt navigation, seamanship, and engine maintenance. They were also instructed in book-keeping. The course took two years. It was found to be useless to attempt to train men older than about twenty years. The youths paid a deposit of \$100 at commencement of training and this was returned to them upon completion of the course. Government provided technical education, food, clothing and pocket money, all of which cost about \$80 per student per month. The course improved the health and well being of the students. It was intended that the youths should return, at the completion of their training to fish in their own districts, and it had also been intended to provide subsidies for them. The scheme was closed by the war, but would be revived.

The delegate from Ceylon described the system of loans to fishermen in force in that country. These were of two kinds: individual loans of up to 500 rupees, or half the value of the gear, repayable in five instalments during the fishing season with interest at 3% per annum. The other type was of loans to groups or to fishing societies and was controlled by the Co-operative Department. The Government took 50% of the catch in repayment of the loan, and purchased the remainder, but in poor seasons the Government might forgo its share. Total of loans were as follows:-

	Individual loans	Group Loans
	rupees	rupees
1st year	70,000	55,000
1943/44	250,000	
1945/46	65,000	900,000

AGENDA Item IX. Staffing Fisheries Departments: Discussion took place on the problem of obtaining trained staff for administrative, developmental and investigational work in fisheries.

Reference was made to the deficiency in fishery schools of sufficient academic standing; basic University training in general biology and other necessary subjects was easily procurable, but post-graduate specialised training for fisheries was not available. The importance of special training in tropical fisheries, for workers in this area, was emphasised. There was unanimous agreement that there should be a school for tropical fisheries.

AGENDA Item X. **Health Aspect.** This item dealt with food poisoning, the control of the processing and marketing of fish and the need for control of malaria.

AGENDA Item XI. **Poisoning and Dynamiting of Fish.** The evil effects of these practices were said to be recognised in all territories.

AGENDA Item XII. **International Collaboration.** It was considered that fishery problems could be dealt with only by international collaboration, for they extended over many oceans common to all nations. The common nature of these problems and the dearth of trained personnel were among the arguments for the early establishment of some form of international collaboration in this area.

The Conference examined the administrative, technical and scientific aspects of the fishing industries, existing and potential, in this area. It was recognised that this is generally a homogeneous region in which the fundamental problems are similar, the methods of investigation the same, and the application of the results similar in principle. It was pointed out that there is such a dearth of trained personnel, by whom these investigations might be prosecuted, that these investigations should not be carried out independently.

The present situation is that each territory tends to select for investigation those problems which are of most immediate importance to its economy, but this manner of working is inadequate and inefficient because, among other things, those conducting such isolated investigations do not have the full range of data applicable to each problem.

This conference considered that the proper method of attacking the problems in this area is one involving a large measure of international collaboration, or, if possible, complete international co-ordination, and recommended, therefore, the establishment of a permanent Eastern Fisheries Council by which such co-ordination will be effected.

The conference passed the following resolution:

RESOLUTION

No. 8.

**INTERNATIONAL
COLLABOR-
ATION.**

This conference recommends that governments give full consideration to the acceptance and principles of international collaboration in respect of the fisheries of the area defined below. A central council should be established under the Food and Agriculture Organization, but for the pre-

sent it is hoped that the Special Commissioner who convened this conference, will establish a follow-up organisation on which the future work under the aegis of the Food and Agriculture Organization of the United Nations may be developed.

It was reported that at the meeting of the Food and Agriculture Organization of the United Nations in Copenhagen in September 1946, it was recommended that an international fisheries council should be established in this area.

It was suggested that there should be an International Eastern Fisheries Council, concerned with an area bounded by parallels of latitude 30°N and 60°S, and by meridian of longitude 65° East and 180° East.

One of the delegates queried the inclusion of New Zealand, but it was felt that New Zealand should be included because there is not likely to be any other international organisation which it can join. Probably the area would be divided into sub-groups, of which New Zealand, Southern Australia and Tasmania would form one, but this was a matter for future consideration.

The Conference gave the following synopsis, which does not however represent the programme which will be developed immediately, but indicates the scope of the problems from which the selection will be made according to the circumstances and requirements:-

- (i) Stimulation and encouragement of member territories to carry out fully and efficiently the best programme for fisheries development.
- (ii) International agreement relating to restrictions on gear, boats and some agreement on territorial limits.
- (iii) Standardization of statistical methods. Collection, compilation and publication of statistics for international use.
- (iv) Exchange of information on methods of production, marketing, processing and all matters connected with fisheries and marine and fresh water development.
- (v) Consideration of regional production programmes in consultation with the Food and Agriculture Organization of the United Nations in respect of world requirements.
- (vi) Co-ordination of research programmes including the possibility of establishing research stations.
- (vii) Agreement on the allocation of special research programmes to countries where these can best be prosecuted.
- (viii) Direct exchange of information and literature with the collection of data applicable to any particular research.
- (ix) Standardization of technique and nomenclature.

- (x) Provision for the interchange of research personnel and facilities.
- (xi) Publication of reports, abstracts and reviews.
- (xii) Exchange of students and personnel and the conduct of an international fisheries school.

The services of an International Council to effect the foregoing co-ordination will be:-

- (a) Holding of Conferences.
- (b) Appointment of Sub-Committees in each area.
- (c) Maintenance of a permanent secretariat which would convene Conferences, co-ordinate Sub-Committees and arrange for publications; collect statistics and co-ordinate research.
- (d) Advise on the conduct of schools and research stations.

II. The Baguio Meeting, February 1948.

This meeting was convened by the Director General of the United Nations Food and Agriculture Organization, acting in accordance with a resolution of the 1947 Session of the Conference of FAO which directed the Fisheries Division of FAO to take action to initiate the formation of 'Regional Councils for the scientific exploration of the sea in parts of the world not now actively served by similar bodies, giving primary consideration' to certain areas of which the South Western Pacific and Indian Ocean was one. Representatives of Burma, China, France, India, Netherlands, Philippines, United Kingdom and United States attended this meeting and observers from Italy, SCAP and UNESCO were present.

The major business of this meeting was the drafting of an agreement for the establishment of the Indo-Pacific Fisheries Council; a copy of the agreement, together with its covering resolution, is given at the end of this section.

Since the Council would not come into existence until five members of FAO had accepted the agreement, and its inaugural meeting might not be expected to take place until at least a few months following receipt of the fifth acceptance, the meeting appointed four interim working committees.

It was intended that these committees should ensure continuity of the Council's preparatory work. Committees were appointed for Hydrology, Biology, Taxonomy and Technology; they met and submitted reports which were adopted by the meeting. The main points of these reports are summarised on pages 15 to 18.

Bearing in mind the problems of overlap between various fields in which the Council will be interested, the Meeting passed the following resolution on liaison with other International Bodies.

"That this meeting draws the attention of the proposed Indo-Pacific Fisheries Council to the need for the avoidance of duplication of effort between the proposed Indo-Pacific Fisheries Council and any similar bodies created by other International Organizations and desires to record its opinion that the Indo-Pacific Fisheries Council should be regarded as the principal organ in those fisheries matter coming within its competence."

THE AGREEMENT

"RESOLVED

That the representatives of governments members of the Food and Agriculture Organization of the United Nations here assembled, recognizing the mutual interest of their several nations in the development and proper utilization of the living aquatic resources of the Indo-Pacific areas, and believing that this end can best be attained by international collaboration, do hereby recommend to their respective governments for consideration, the acceptance of the following agreement for the establishment of an Indo-Pacific Fisheries Council."

Agreement for the establishment of the Indo-Pacific Fisheries Council.

Preamble

The Governments of Burma, China, France, India, the Netherlands, the Republic of the Philippines, the United Kingdom and the United States of America, members of the Food and Agriculture Organization of the United Nations, having a mutual interest in the development and proper utilization of the living aquatic resources of the Indo-Pacific Areas, and desiring to further the attainment of these ends through international co-operation by the establishment of an Indo-Pacific Fisheries Council agree as follows:

Article I

The Council

1. The contracting Governments agree to establish a Council, to be known as the Indo-Pacific Fisheries Council, for the purpose of carrying out the functions and duties hereinafter set forth in Article III.

2. The members of the Council shall be the Governments which accept this Agreement in accordance with the provisions of Article IX thereof.

Article II

Organization

1. Each member Government shall be represented at meetings of the Council by a single delegate, who may be accompanied by an

alternate and by experts and advisers. Participation in meetings of the Council by alternates, experts and advisers shall not entail the right to vote, except in the case of an alternate who is acting in the place of a delegate during his absence.

2. Each member Government shall have one vote. Decisions of the Council shall be taken by a simple majority of the votes cast, except as otherwise provided by this Agreement. A majority of the total membership of the Council shall constitute a quorum.

3. The Council shall elect a Chairman and a Vice-Chairman.

4. The Council shall determine the frequency, dates and place of its meetings, and establish rules governing its procedure.

5. The chairman shall call a meeting of the Council at least once in every year, unless directed otherwise by a majority of the member Governments. The initial meeting shall be called by the Food and Agriculture Organization of the United Nations within six months after the entry into force of this Agreement and at such place as it may designate.

6. The seat of the Council shall be at the seat of the Regional Office of the Food and Agriculture Organization of the United Nations most conveniently situated within the area defined in Article IV. Pending the establishment of such a Regional Office, the Council shall select a temporary seat within that area.

7. The Food and Agriculture Organization of the United Nations shall provide the Secretariat for the Council and shall appoint its Secretary.

Article III

Functions

The Council shall have the following functions and duties:

- a. To formulate the oceanographical, biological and other technical aspects of the problems of development and proper utilization of living aquatic resources;
- b. To encourage and co-ordinate research and the application of improved methods in every day practice;
- c. To assemble, publish or otherwise disseminate oceanographical, biological and other technical information relating to living aquatic resources;
- d. To recommend to Member Governments such national or co-operative research and development projects as may appear necessary or desirable to fill gaps in such knowledge;
- e. To undertake, where appropriate, co-operative research and development projects to this end;

- f. To propose, and where necessary to adopt, measures to bring about the standardization of scientific equipment, techniques and nomenclature;
- g. To extend its good offices in assisting Member Governments to secure essential materials and equipment.
- h. To report upon such questions relating to oceanographical, biological and other technical problems as may be recommended to it by Member Governments or by the Food and Agriculture Organization of the United Nations and other international, national or private organizations, with related interests;
- i. To report annually to the Conference of the Food and Agriculture Organization of the United Nations upon its activities, for the information of the Conference; and to make such other reports to the Food and Agriculture Organization of the United Nations on matters falling within the competence of the Council as may seem to it necessary and desirable.

Article IV^{*}

Area

The Council shall carry out the functions and duties set forth in the Article III in the Indo-Pacific Areas.

Article V

Co-operation with International Bodies

The Council shall cooperate closely with other international bodies in matters of mutual interest.

Article VI

Expenses

1. The expenses of delegates and their alternates, experts and advisers occasioned by attendance at meetings of the Council shall be determined and paid by their respective Governments.

2. The expenses of the Secretariat, including publications and communications, and of the Chairman and Vice-Chairman of the Council when performing duties connected with its work during intervals between its meetings, shall be determined and paid by the Food and Agriculture Organization of the United Nations within the limits of an annual budget prepared and approved in accordance with current regulations of that Organization.

3. The expenses of research or development projects undertaken by individual members of the Council, whether independently or upon the recommendation of the Council, shall be determined and paid by their respective Governments.

4. The expenses incurred in connection with co-operative research or development projects undertaken in accordance with the provisions of Article III, paragraphs (d) and (e) unless otherwise available shall be determined and paid by the members Governments in the form and proportion to which they shall mutually agree.

Article VII

Amendments

Any proposal for amending this Agreement shall require the approval of a two-thirds majority of all the Members of the Council. An exception to this rule is made in the following cases:

(1) Amendments to the Agreement extending the functions of the Council require the approval of the Conference of the Food and Agriculture Organization of the United Nations in addition to approval by a two-thirds majority of all the Members of the Council;

(2) Amendments of the Agreement extending the powers of the Council to incur expenses to be borne by the Food and Agriculture Organization of the United Nations, shall require the approval of a two-thirds majority of all the Members of the Council and of the Director-General of the Food and Agriculture Organization of the United Nations.

Article VIII

Acceptance

1. This Agreement shall be open to acceptance by Governments which are members of the Food and Agriculture Organization of the United Nations.

2. This Agreement shall also be open to acceptance by Governments which are not members of the Food and Agriculture Organization of the United Nations, with the approval of the Conference and of two-thirds of the members of the Council. Participation by such Governments in the activities of the Council shall be contingent upon the assumption of a proportionate share in the expenses of the Secretariat, as determined by the Council and approved by the Food and Agriculture Organization Conference.

3. The notifications of acceptance of this Agreement shall be deposited with the Director-General of the Food and Agriculture Organization of the United Nations, who shall immediately inform all the Governments concerned of their receipt.

Article IX

Entry into Force

1. This Agreement shall enter into force upon the date of receipt of the fifth notification of acceptance.

2. Notifications of acceptance received after the entry into force of this Agreement shall enter into force on the date of their receipt by the Director-General of the Food and Agriculture Organization of the United Nations who shall immediately inform all the Governments concerned and the Council of their receipt.

Article X

Withdrawal

Any member Government may withdraw from this Agreement, at any time after the expiration of two years from the date upon which the Agreement entered into force with respect to that Government by giving written notice of such withdrawal to the Director-General of the Food and Agriculture Organization of the United Nations who shall immediately inform all the Governments concerned and the Council of such withdrawal. Notices of withdrawal shall become effective three months from the date of their receipt by the Director-General.

Formulated at Baguio this 26th day of February, one thousand nine hundred and forty-eight, in the English language, in a single copy which shall be deposited in the archives of the Food and Agriculture Organization of the United Nations, which shall furnish certified copies thereof to the Governments members of the Food and Agriculture Organization of the United Nations.

and further

"RESOLVED

That the Director-General of the Food and Agriculture Organization of the United Nations be requested to communicate the text of the agreement adopted by the meeting, together with this resolution, to all Governments members of the Food and Agriculture Organization of the United Nations; and that the governments here represented and any other Member Government that may be interested be invited to accept the agreement."

"RESOLVED

That the working Committees appointed at this Conference continue to function informally until the entry into force of the Agreement in co-operation with the Fisheries Division of the Food and Agriculture Organization of the United Nations."

The Reports of the Interim Working Committees.

The **Committee for Taxonomy** presented a detailed programme for five years work of which the first would be exploratory, the second devoted to collection and codification of information, the third to collection and publication of material and the fourth and fifth to continuation of these activities. The exploratory work of the first year would include the following projects:-

1. Definition of the Indo-Pacific Region.
2. Examination of existing facilities with a view to their employment on behalf of the regional programme of the Council.
3. Consideration of the establishment of standard international collections.
4. Suggesting ways of completing national collections.
5. Preparation of a bibliography.
6. Development of co-ordination among taxonomic laboratories.
7. Establishment of co-ordination between the Council and international bodies such as the International Commission for Zoological Nomenclature.

The Committee proposed for the second year the preparation of check-lists and handbooks and initiation of racial investigations. The third year would be devoted to the publication of the check-lists and handbooks prepared in the second year and to preparation and publication of distribution maps and to organization of collecting expeditions.

The **Committee for Biology** submitted a definition of fisheries biology, as follows:

"Marine Biology and Freshwater Biology comprehend the whole of the phenomena of the aquatic biosphere and include such reference to the accompanying physical and chemical phenomena as might be required for a proper understanding of the biotic phenomena. Although they overlap fisheries biology, they do not include it since that science must take cognizance of economic, social and technological data which do not fall within the consideration of the other two; fisheries biology may be regarded as a specialization of biology (more especially of ecology) applied to groups of aquatic organisms which are of actual or potential economic importance to man, and modified (from pure biology) by its employment of certain non-biological data. It is concerned with the identification of the natural units of stocks of these organisms, with the elucidation of migratory, feeding and reproductive habits and of growth and mortality rates, and with the measurement of population levels including measurement and analysis of fluctuations of these levels and the effect upon them of fishing operations; it aims at the formulation of programmes for the effective utilization of these resources."

The Committee recommended co-ordination of the work in fisheries biology with that in the subjects of the other committees and urged that the principal immediate concern of the Council should be to stimulate and assist member Governments in their assessments of the living aquatic resources of the area and the development and maintenance of maximum production from these resources. It emphasized the importance of statistical compilations. As a first step toward these ends, by the Council, the Committee proposed the conduct of a survey of existing institutions, programmes and so

forth and submitted a draft questionnaire by means of which the survey might be conducted.

The **Committee for Hydrology** submitted the following programme to cover five years of activity:-

1. Compilation of references and copies of oceanographic data for the Indo-Pacific areas, as a first step in the programme to obtain a working knowledge of the areas.

2. Preparation of a map of the Indo-Pacific areas showing principal producing regions within this area. This map will serve the purpose of revealing the lacunae in our knowledge of hydrology as it is related to biology.

3. In order to further any co-ordinated programme of research in hydrology, the committee deems it necessary to reach agreement concerning methods and procedures (standard methods of investigation).

4. To carry out the above programme the committee wishes to recommend to the Secretariat by a resolution herewith appended, that an oceanographer with sufficient secretarial assistants be retained as a member of the Fisheries Staff of the Food and Agriculture Organization of the United Nations.

5. That a special list be compiled of the available research vessels, including naval and commercial vessels that could be drawn upon for assistance in obtaining observations, instruments and other materials necessary for oceanographic research.

For the *second year* the committee proposes to meet and consider the establishment of an observational pattern based upon the materials accumulated in the first year. Since there are known to be vessels operating in the Indo-Pacific areas and as it is known that others are being planned for, a co-ordinated programme will be established for the most efficient use of the effort now being expended. The committee would like the opportunity of including in these plans such work as is contemplated by the other committees of the Indo-Pacific Fisheries Council in order that maximum use be made of existing facilities.

For the *third to fifth year* the committee should like to initiate a co-ordinated programme of hydrographic observations.

The **Committee for Technology** submitted a definition of its subject, proposing a division into two sections concerned, respectively, with food and gear. The Committee's definition was as follows:-

"Fisheries Technology: it is suggested that this term should be employed for the technological practices of the fishing and allied industries and be divided into two halves, concerned with the gear (including boats) and food problems. The connotation of these terms would be as follows:-

"*Fisheries Food Technology*: the technical problems of handling fishery food products, and by-products, from the moment of removal from water, and including storage, transport, processing, packing and distribution.

"*Fisheries Gear Technology*: the technical problems of the gear, apparatus and boats employed by fishermen in the searching for, capture and transport to point of landing (or of processing) of fish. Including the special problems of naval architecture presented by the requirements for fishing operations, the problems of materials such as wood, fibres, metals and plastics employed in fishing gear, the design of gear, experimentation in its use and so forth, and fish pond engineering."

The Committee proposed a programme involving the compilation of reports on gear and equipment, fishing methods, piscicultural techniques and so forth in use in the area.

Since each of the Committees proposed a survey within its own field of work, and since these several fields are frequently the concern of a single institution, it was agreed by the Chairmen of these committees that a single survey document, to cover all four fields, should be prepared and circulated by the Secretariat. This was done.

III. The Buitenzorg Meeting, October 1948.

This meeting was described as an Area sub-committee meeting. It was convened by the Chairmen of the Interim Working Committees for Hydrology (Professor Dr. L. G. M. Baas Becking, Netherlands) and Biology (Mr. D. W. Le Mare, United Kingdom). Representatives from Hong Kong, North Borneo, Philippines and the Netherlands attended the meeting. The purpose of the meeting was to consider the problems of the marine fishery resources of the Celebes and Sulu Seas and adjacent waters and the various programmes, existing or proposed, for their investigation and development. Statements* were made by each of the delegates and the material so presented served as a basis for discussions on programmes and measures for collaboration; a series of resolutions was formulated, as given below. In addition to the daily sessions of the meeting, the delegates were taken on excursions to points of scientific interest in the neighborhood and in three evening sessions a symposium on "Methods of Investigation of Deep-sea Areas for Fisheries Work" was held.

[*It is understood that the material presented in these statements will be referred to by the Chairman of the appropriate Working Committees in the course of the Council Meeting.]

Resolutions

This Meeting resolves that

Whilst regretting that the U.S. Fish and Wildlife Service Philippine Fishery Program is not represented directly at this meeting and has not made available such information as could have been desired, it appreciates the statements which have been furnished and requests the Director of the Philippines Bureau of Fisheries to furnish the the Secretariat with such other information as might be desired, especially in relation to the biological results of the programme;

and further resolves

To request the Secretariat to establish formal contact with the U.S. fisheries programme in this area to ensure its full representation at the meetings of the Indo-Pacific Fisheries Council and its participation in the activities of the Council in the full manner to be expected of all members of the Council.

Whereas it is understood that the Japanese accumulated considerable oceanographic data relating to the waters of the Indo-Pacific area,

And whereas the availability of such data to all workers of this area would probably be of considerable assistance to these programmes,

This Meeting resolves

To urge the Governments now in possession of these data to make them freely available to all workers of the area, preferably through the Secretariat, and

To request the Secretariat to take steps to secure these data.

Whereas the social and economic factors of the fishing industry are of considerable importance and it is essential that they be taken into consideration in any plan for the development of the industry and whereas this is especially true for the Indo-Pacific region,

This Meeting resolves

To recommend to the Indo-Pacific Fisheries Council that at its Inaugural Meeting it should declare its interest in socio-economic problems and should appoint a Technical Committee for social and economic work, it being assumed that such a Committee would work in closet liaison with other organizations interested in this field of study.

And further this Meeting resolves

To recommend to the Indo-Pacific Fisheries Council that among the social and economic problems urgent consideration should be given to the methods by which fishermen might be freed from indebtedness preferably by the wide spread foundation of Government Credit Organizations.

Resolution I

Information
on the U.S.
Fish &
Wildlife
Service
Philippine
Fishery
Programme.

Resolution II

Japanese
Oceanogra-
phic work.

Resolution III

Socio-
economics

Resolution IV

Co-ordination
of oceano-
graphic
programmes.

Whereas relatively little is known of the productivity of the Celebes and Sulu Seas and adjacent waters, and

Whereas information on productivity is urgently required for the development of fisheries in these waters,

This Meeting resolves

To recommend to the Governments here represented that they should take steps as early as possible to initiate a co-ordinated oceanographical programme and that their respective programmes should be planned to fit in with the current Philippine programme;

And further resolves

To recommend to the Indo-Pacific Fisheries Council that it take steps to secure the fullest possible co-ordination of programmes in the area;

And finally resolves

To request the Secretariat to ascertain the schedule of stations which will be occupied in the area by the Philippine programme, and on the basis of the information furnished to propose a pattern of work allowing for Indonesian operations in waters East of the Halmaheras, for North Borneo operations (later) in Southern Sulu Sea and for Malayan operation in the South China Sea.

Resolution V

Philippine
programme
of observa-
tion and
sampling

This Meeting resolves

To request the Secretariat to ascertain the programme of observation and sampling being followed by the Philippine workers and to communicate this information to Governments concerned in accordance with Resolution IV;

And resolves

To recommend to such Governments that they should adopt this as a minimum programme.

Resolution VI

Programme
on pelagic
fisheries.

Whereas a major interest in the Celebes and Sibu Seas and adjacent waters is in the prospect of developing pelagic fisheries

And whereas realization of these projects will require collection of data on hydrological and biological factors of these waters;

This Meeting resolves

To recommend to the Governments represented here that they should make their programmes as complete as possible, having regard for the recommendations of the resolutions which follow,

And that they should bear this recommendation in mind when appointing new staff, so that, where possible, gaps in the array of specialists may be filled;

And further resolves

To recommend to the Indo-Pacific Fisheries Council that it should present this recommendation to other Governments.

Whereas the factor which most seriously hampers progress of research and development programmes of this area is the lack of trained personnel so that there is a need to make the fullest use of all available persons. Resolution VII

And whereas also it is desirable to make the fullest use of the experience of the leading worker in each field;

Panel of Experts.

This Meeting resolves

To recommend to the Indo-Pacific Fisheries Council that it establish a panel of names of specialists to be a reference point for the subjects in which they specialise, to give directions in method of observation and collection and, where possible, to receive and handle collections made in the area; such a panel would be reviewed from time to time; a tentative list is attached as annexure to this resolution, and the Secretariat is directed to communicate with the people named on the list to ascertain their willingness to act in the capacities indicated in this resolution.

This Meeting further resolves

To recommend to the Indo-Pacific Fisheries Council that it endeavour to arrange that whenever collections are made in this area, duplicate material should be retained in the area under the supervision of the specialists concerned with the groups represented.

HYDROLOGY

<i>Physical</i>	-	P. Ch. Veen, NETHERLANDS.
<i>Chemical</i>	-	D. Rochford, AUSTRALIA.
		M. van Raalte, NETHERLANDS.

BIOLOGY

<i>Bacteria</i>	-	
<i>Plankton</i>	-	H. Delsman, NETHERLANDS.
<i>Algae</i>	-	J. S. Zaneveld, NETHERLANDS.
		Mrs. Valerie Jones, AUSTRALIA.
<i>Porifera</i>	-	H. Srinivasa Rao, INDIA.
<i>Worms</i>	-	
<i>Mollusca</i>	-	Mrs. Thera van der Feen, NETHERLANDS.
		Miss Joyce Allen, AUSTRALIA.
<i>Crustacea</i>	-	M. W. F. Tweedie, SINGAPORE.
<i>Penaeidae</i>	-	K. Sheard, AUSTRALIA.
<i>Hydrobatids</i>	-	M. A. Lieftinck, NETHERLANDS.
<i>Echinodermata</i>	-	W. K. Fisher, CALIFORNIA
		E. Mortensen, DENMARK.
<i>Tunicata</i>	-	H. Thompson, AUSTRALIA.
<i>Pisces</i>	-	S. L. Hora, INDIA.
		J. D. F. Hardenberg, NETHERLANDS.
		G. P. Whitley, AUSTRALIA.

Reptiles

- M. Tweedie, SINGAPORE.
P. E. P. Deriniyagala, CEYLON.

Birds

- C. A. Gibson-Hill, SINGAPORE.
D. L. Serventy, AUSTRALIA.
D. J. Manuel, PHILIPPINES.

Mammalia

- T. Vervoort, NETHERLANDS.
H. van Deinse, NETHERLANDS.

Resolution VIII

Whereas this Meeting has been informed of the fellowships available for research work at Buitenzorg,

Fellowships

And whereas it believes that availability of opportunities for research workers to travel throughout the area and participate in programmes other than their own is an important means of furthering the principle of collaboration and co-ordination;

The Meeting resolves

To recommend to the Indo-Pacific Fisheries Council that it take steps to encourage the establishment of more fellowships and to secure the agreement of member Governments to the provision of reciprocal facilities for work.

Resolution IX*This Meeting resolves*

To recommend to the Indo-Pacific Fisheries Council that it take steps to secure through its technical committees, standardization of terminology and methods;

Standardization of terminology and methods

And to suggest to the Secretariat that it undertake a compilation of existing conventions on standardization, for the interim use of workers in the area and to serve as a basis to the work of the technical committees.

Resolution X*The Meeting resolves*

Central Bureau for collation of data.

To recommend to the Food and Agriculture Organization of the United Nations and to the Indo-Pacific Fisheries Council that the functions of the Secretariat should include the maintenance of a Central Bureau to receive and collate results of work in the area and

To recommend that the staff of the Secretariat should be expanded to include a technical assistant to handle the work.

Resolution XI*The Meeting resolves*

Review of progress of programmes.

To recommend to the Indo-Pacific Fisheries Council that the work of its technical committees should be actively developed to include effective and sustained review of the progress of programmes in this area.

Resolution XII

Whereas it regrets that a representative of the fisheries organisations of the Australian Government was not present at this meeting,

This Meeting resolves

To request the Secretariat to ascertain the Schedule of stations which will be occupied by the Australian programme in waters adjacent to the area under immediate consideration and such other information as may be desired.

Information
on Australian
programmes.

PART 2.

The Fisheries of Malaya and Singapore.

We propose to give here a very general account of the fisheries of the Malayan Peninsula and the islands of Singapore and Penang. With Sarawak, Brunei and North Borneo, of whose fisheries some notes are given in an appendix, these form the territories in South East Asia which are members of the British Commonwealth. Their main interest for fisheries workers arises from the fact that they lie near the centre of the complex which forms the core of the Indo-Pacific biogeographic region. The fish stocks upon which these fisheries operate have a composition almost the same as those observed in Indonesia, the Philippines, Siam, Cambodia and Burma, and differing little from the composition of stocks exploited in India, Ceylon and Pakistan in the west, Annam, Southern China, the Pacific Islands and northern Australia in the east. From the biological point of view the problems are the same as or very similar to those in the remainder of the Indo-Pacific; the methods and techniques of research and development will have general applicability and the results an equal validity. The same is true, in varying degree, for other lines of enquiry, such as the hydrological. From the socio-economic and technological point of view the area has many aspects of particular interest. The industry is basically Malayan, expressive of the native peoples and in this regard alone is of considerable interest; to this sub-stratum, are added Chinese elements, chiefly in the financing of operations and in marketing and distribution but also, significantly, in the gear technology (*vide* the account of the purse seine given below on page 51); western influences also have come to bear on the industry, notably in the form of mechanisation of various operations, and of course the administration is western and is bringing to the industry western views on the investigation and management of the resource and its industry and the proper means for its development. We must also recognise the persistence, and probable recrudescence in the future, of Japanese influences. Finally, we must note, more particularly for Singapore, the effect upon the primary communities of urbanisation.

The account which follows does not aspire to completeness: that would imply that the knowledge of these fisheries was far more advanced than it is, but in any case the time available for preparation of this work has been too little to allow more than the sketching in of the main outlines of the picture; the work which is planned by the U.K. Government will add detail. The account is the result of team effort; much of it is drawn from published material and from official sources; it is hoped that it will convey an adequate impression of the most important features of the industry of this part of the world.

IV. THE GEOGRAPHIC SETTING OF MALAYAN FISHERIES.

(by E. H. G. Dobby).

Malaya's fishermen are hedged in at the coast by equatorial forest. Their huts appear spindle-legged, ragged, dwarfed by trees, from a distance looking like villages of matchsticks tied together with bits of string. What seems to the stranger a flimsy settlement is in fact constantly renewing itself, so that many fishing villages have existed in much the same places and forms for centuries.

The way of life of the people in them represents the Malayan response to a setting which has no exact counterpart elsewhere.

Located roughly centrally to the Sunda Platform, Malaya is surrounded by shallow seas which mask its physical continuity with Borneo and Eastern Sumatra. Upon the floor of the Malacca Strait, the South China Sea and the narrow straits leading south of Singapore through a maze of islands to the Java Sea, lie sands, muds and gravels at depths only occasionally greater than 200 ft. and for hundreds of square miles not exceeding 100 ft. The Cathay Building in Singapore could stand almost anywhere in these seas and show much of itself above the water.

Across their floors may be traced old river channels. At each glacial period familiar to physiographers of North America and Europe these seas receded and vegetation advanced seaward, allowing a great river system to run northeast through the South China Sea with tributaries from Malaya, South Sumatra and West Borneo and a smaller system to run northwest through the Malacca Strait. Since the last glacial period the seas have been advancing and the rivers have been detrunked. For something like a million years, the marine environment of Malaya has been one of successive advances and retreats of shallow seas whose beds are therefore of terrestrial materials.

Into the seas round Malaya intrude neither high latitude currents nor upwellings of deep sea water. Their movements are largely conditioned by winds and tides. The greatest surface transfers from the open ocean come through the South China Sea which to the north is only lightly screened by the Philippines from the steady westward pressure of the Pacific Equatorial Current.

Tides reach Malaya as progressive waves from the Pacific on the east by way of the South China Sea, and on the northwest from the Bay of Bengal through the Malacca Strait. These tides converge off South Malaya, augmenting or neutralising one another to produce a complex tidal streaming through the Rhio and Lingga Archipelagoes.

Down the length of the South China Sea from late November to March sweeps a northeast wind which carries the surface before it, bringing strong winds, heavy rains and violent seas to Malaya's

East Coast. That coast may then be isolated from sea contacts for many weeks and unsafe for fishing craft. The West Coast on the lee-side is much less affected at this time.

South or southeast winds dominate Malaya from June to September. Travelling athwart the Malacca Strait, they acquire less grip on its waters and their impact on the west, while producing swells and rains, does not prevent fishing or coastal traffic. On the east, this season is the best for fishing and for coastwise movement. Between Malacca and Singapore, however, may occur days of very violent local squalls ("Sumatras") during which no fishing is possible.

Although strong local convectional storms may take place, the months March to May and October/November are often calm and the diurnal rhythm of land and sea breezes becomes emphatic. It is apparent even during other seasons and makes itself felt in both the daily rhythm and the daily range of Malay fishing boats.

At coasts, as upon the mainland, these wind changes mark the seasons of the year: their effects on places vary according to the aspect.

Shallowness and isolation result in Malayan seas being nearly isothermal, superficially and in section, and their low latitude explains their warmth.

Into them discharge many rivers. Both land and sea receive heavy rainfalls of the order 100 inches annually. Hence Malayan seas have low salinity (about 3.1%) especially inshore. The run-off of fresh water is fairly steady and from the deforested areas carries heavy loads of terrestrial debris which supports scavenging sea fauna. The discharge of the freshwater is most constant to the south and becomes more seasonal northwards, peaking on the northeast in November/December, and on the northwest in September/October.

Longshore drift on the East Coast, aided by the powerful north-east winds, tends to build sandbars across the rivers and to beat up arcuate spits which in conjunction with the heavy rainfalls produce belts of fresh-water swamp spreading well inland over the lowlands of Pahang and East Johore.

To the west the sealing of rivers by sandbars is less advanced but modern destruction of the natural forest cover and the heavy rains have led to much erosion followed by coastal sedimentation.

The encroachment of land on sea has been faster because the narrow Malacca Strait restricts strong scouring by tides or southwest winds. The growth of mangrove forest (Pl. 1) has accompanied the coastal sedimentation which shows from Kedah to the Straits of Johore. In Kedah this silting coast has been extensively reclaimed for padi cultivation.

Muddying by the waters discharging into the Malacca Strait offsets locally the high angle of incidence of equatorial sunlight and accentuates the effects of equatorial overcast skies which have highest annual frequency towards Singapore where 172 days per annum are cloudy. To the north cloudiness is more seasonal, reaching a maximum in December at Kota Bahru and in October at Alor Star.

Thus the freshwater swamps of the East Coast and the mangrove swamps of the west flank Malaya with an almost amphibious belt. The transition between sea and land takes place over an unusually broad zone, providing a range of shallow-water fish from two or three miles offshore to well inland where the swamps or the periodically flooded padi-fields give way to higher relief.

These swamp-belts at one time repelled settlement because of the limited potable water available and the technical difficulty of cultivating them. The transport problem they present is scarcely less serious today than in the past when rivers could be used as routes through them but it was difficult to cross them parallel to the coast. Modern roads along the coast are still interrupted by swamps. The Malayan transport system (Fig. C) has its chief arteries well inland, running lengthwise through the Peninsula with branches to the coast which are separated by swamps. These branches have over the last fifty years been the axes from which cultivators have pressed into the marshes.

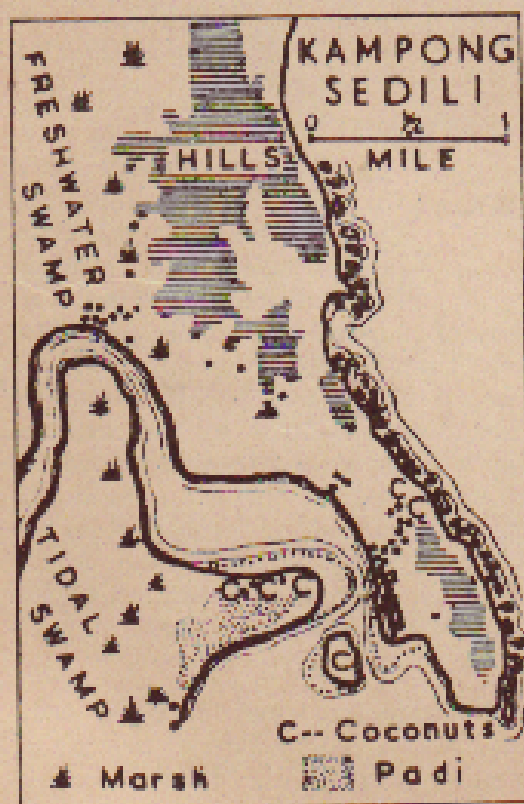


Fig. A

By the swamp-belts the fishermen are in varying degrees isolated landwards (Fig B). That the East Coast suffers violent seas during the southern solstice means that it is then isolated seaward as well as cut off from the interior throughout the year. Along it, the villages are at river mouths, often on the lee of low rocky ridges appearing at the coast en echelon, a site shielding their anchorages from the worst of the northeast winds (Fig A). Only at two points, Kuantan and Mersing, does the Malayan road system reach the east; only Kota Bahru has a railway link to the interior.

On the West Coast, there are no coastal ridges but a series of rocky islands such as Penang and Pangkor,



Fig. D.

ing gravels and well-drained districts suitable for rubber plantation (Fig. B). Thus an inland belt from Taiping through Ipoh and Kuala Lumpur to Johore Bahru carries a dense population on tin mines and rubber plantations linked longitudinally by the road and the railway system. Few of the workers involved produce food for themselves. They form major consumers for the fish caught seaward of those marshes separating the tin and rubber belt from the coast. The development of roads to bring tin and rubber to the western seaboard has facilitated the commercialisation of fishing and the transport of fish inland as part of the general movement of foods to the mines and plantations.

While the people of Malaya divide into three unrelated communities each with patterns of distribution which are to varying extent separate (Fig. E), these scarcely affect the demand for fish which here, as in all Southeast Asia, forms a popular and cheap source of protein. In mining and plantation districts the labourers

provide sources of fresh water at seaboard and draw considerable population. Some of the islands have become linked to the mainland by sedimentation as in the case of the Dindings.

Fishing settlements along the Malacca Straits may take the form of *bagans*, a few huts perched on the steep outer edge of the mangrove and without potable water. More generally there are ribbon-kampongs, lines of huts on a spit or beach wave-built a few feet above its surroundings (Pl. 2). Where sedimentation is proceeding rapidly, there may be several parallel villages on successive old beaches separated by narrow lagoons, ribbons of mangrove or lines of padi-fields, depending upon the stage of reclamation (Fig. D).

The greatest developments of Malaya have taken place on the western flanks of those mountains running roughly centrally NNW to to SSE through the Peninsula. In these foothills lie tin-bearing

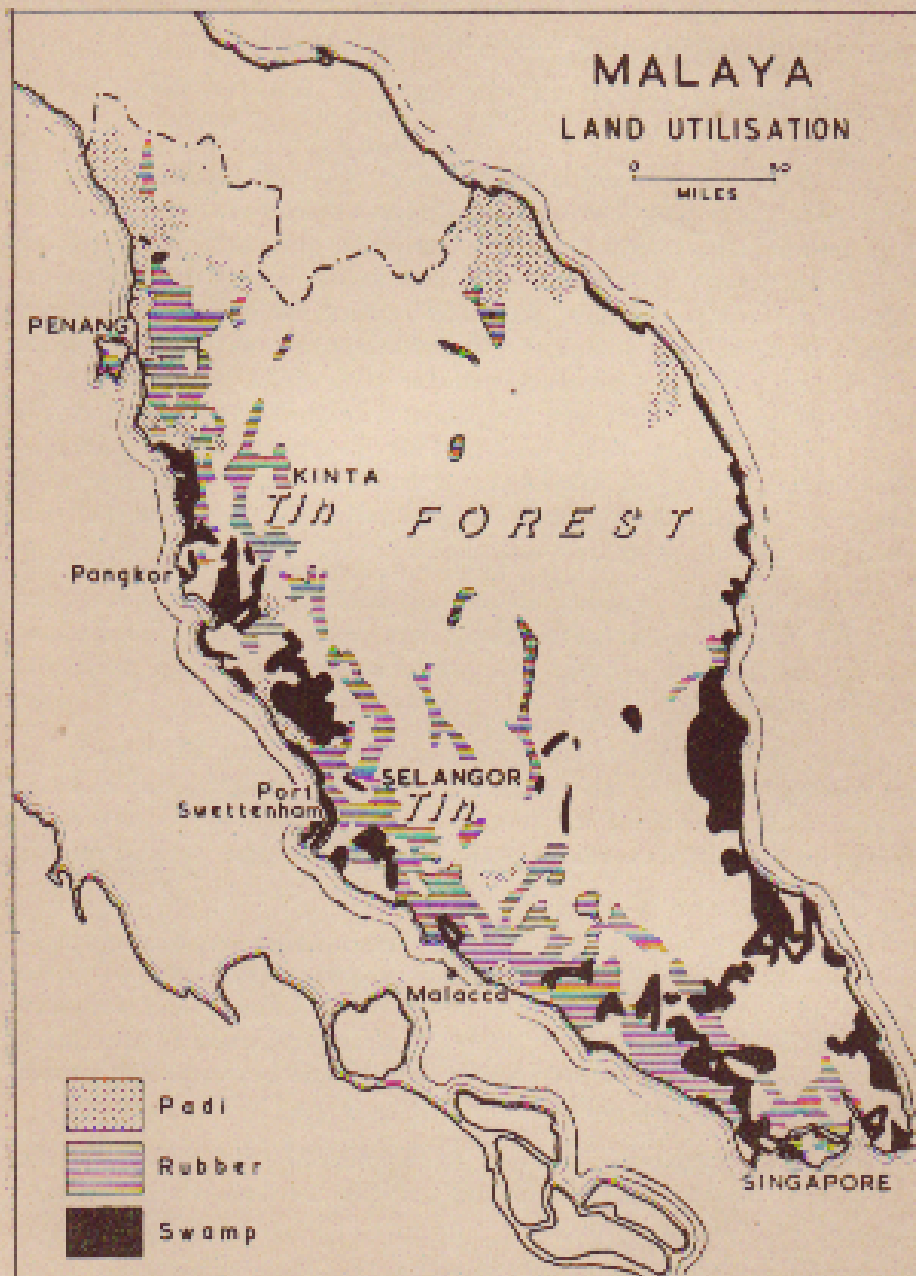


Fig. B.

are chiefly Chinese and South Indian, the former being the heavier eaters of preserved fish, whereas the Tamils alternate it with dhal (dried peas). Urban areas have Chinese majorities except in the extreme north, forming a compact, easily accessible market for fish-foods which is more selective than but not markedly different from that of other communities within Malaya.

The Malayan Indians are consumers of fish yet they play no significant part in catching it.

Land-use patterns inside Malaya (Fig. B) thus establish relations with fishing and have led to varying transitions between subsistence and commercial systems. In the northeast and northwest, fishing links with largely subsistence padi-cultivation and with transitions between farmers and fishermen. The rest of the East Coast is still mainly of nearly self-sufficient groups, sometimes without local padi and trading preserved fish coastwise for rice. The West Coast fishing relates to the inland tin and rubber labourers. At Pangkor, the tie is with the Kinta Valley and at Port Swettenham with Selangor, Which draws also upon fish of the Malacca sea-board in rivalry with Singapore. Both Penang and Singapore have commercial fisheries related to their own urban populations.

That Malaya's weather is one of sustained high temperatures poses for fisheries an acute problem: how to keep the fish from one part of the year to another and while being transported from one place to another.

The solutions vary from the older techniques of sun-curing and spicing which are self-contained, to salting which involves trade in salt, and to modern ice methods requiring the development of ice-making facilities at the coastal end of high-speed road transport to the interior.

While there is no longer a sharp communal or regional specialisation in these technologies, the older types are associated with the Malays and the East Coast, the newer with Chinese and southern parts of the West Coast. There is a similar overall correlation between self-contained forms and the Malays and between commercial forms and the Chinese (Pl. 5).

Irregular coral reefs are met offshore along the rockier coasts, particularly on the East Coast and off the western islands, adding a hazard for netting methods.

If the physiography of the Malayan coast has led its fisheries to be those of shallow waters, the Malayan forest sets a distinctive stamp on the fishing devices which have been evolved. From the forest is available a wide variety of woods, canes, palms, and woody fibres. These are the materials from which the Malayan fisherman makes his equipment, typically of trap forms which reflect his shallow-water interests and his limited range.



Fig. C.

The forest likewise makes his village. The frail jetties, the platforms for drying fish and the stilted, thatched houses originate nearby in the forest. Their aspect is less makeshift than home-made from materials renewable locally and endlessly, so far. From the forest come the fishing craft, keelless, rudderless and shortrange to the north and east, but more elaborate and sometimes motorised to the west and south.

Because the traditional equipment originates locally, it may be easily and quickly replaced or repaired with simple local tools and combats the physical environment by being elastic rather than resistant. Only where commercial fishing predominates does its ecology elaborate to include repair shops, fuel oils, salt, ice, lorries, mechanics and the ramifications of a market system and distant connections.

Malayan fisheries are thus the fulcrum of a delicate balance between human needs, physical difficulties, differing stages of technology, and the limits of a special biotic environment of men, forest and fish. Alterations in one of these involve readjustment in the others and innovations, natural or otherwise, have to be weighed against the shift of balance they may cause in the whole network of relations now in equilibrium on the coasts.

V. FAUNA AND FLORA.

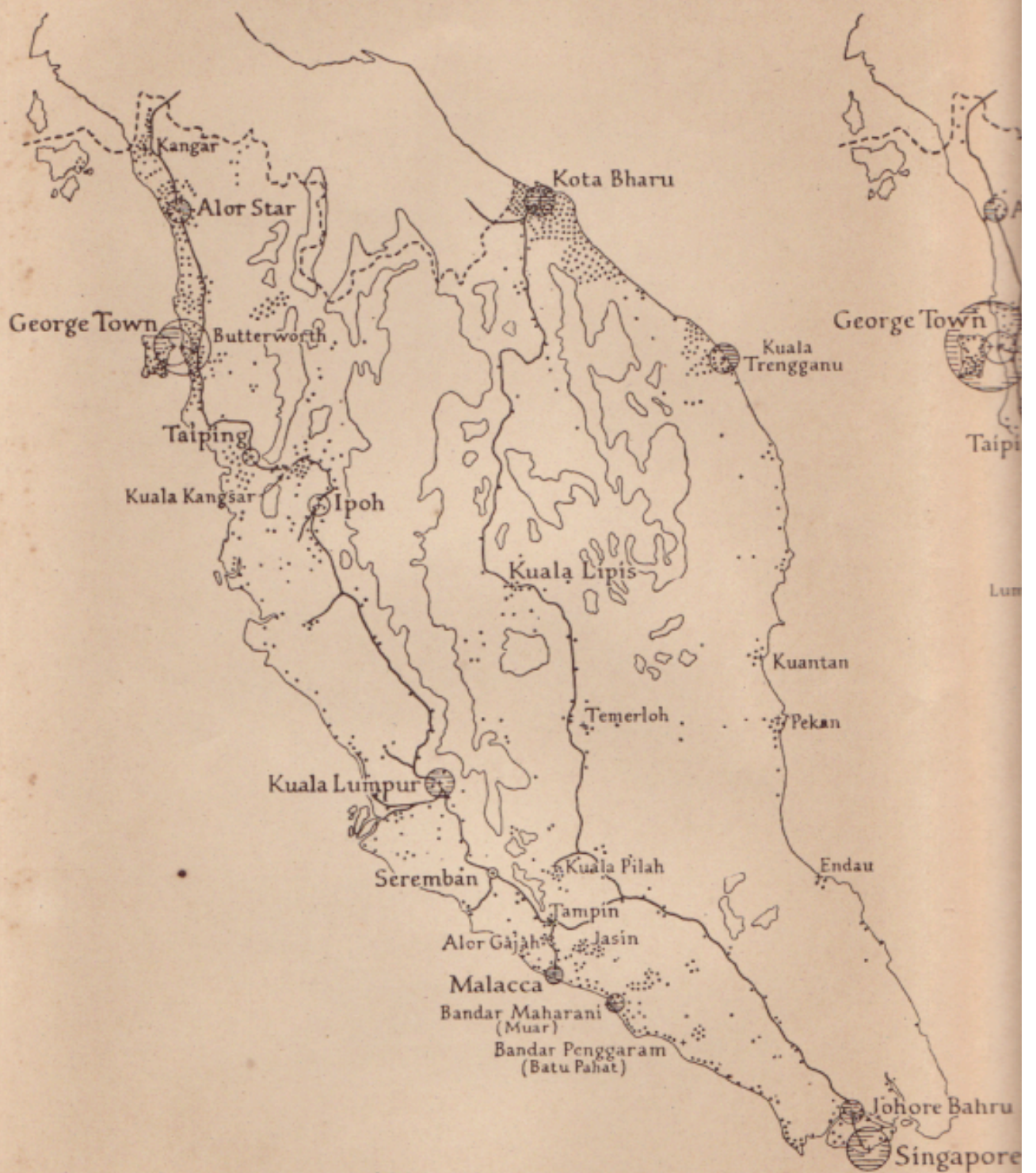
The fauna and flora of this region have, of course, been extensively and carefully studied by a long succession of workers and whilst much remains to be done, the relevant literature is extremely rich. We refer in this connection not only to the literature of Malaya itself, which is indeed extensive, but also to the voluminous literature of adjacent territories, which has direct bearing on the understanding of Malayan biota. The following chapter is not an attempt to summarise this literature, nor to give an effective account of the principal features of this biota nor, finally, to submit any conclusions in respect of it: the chapter consists of a series of brief notes intended to indicate some of the important points whose recollection will serve to bring the biota sufficiently into view to make the present account of Malayan fisheries a balanced one.

A NOTE ON THE VEGETATION

(by M. R. Henderson)

The vegetation of Malaya is tropical rain forest which, before the advent of man, covered the whole country almost entirely, from sealevel to the tops of the highest hills. The absence of a marked dry season ensures that the forest is evergreen, although here and there deciduous trees do occur. The forest canopy is heavy, excluding the greater part of the sunlight, and the forest floor is occupied by a dense cover of tree seedlings, shrubs, palms and a certain number of herbaceous plants. Lianes and epiphytes are conspicuous. This forest cover is fairly uniform in the lowlands and up to 2500 or 3000 ft., where there is a transitional zone. Below this the characteristic and

DISTRIBUTION



TRIBUTION OF POPULATION IN MALAYA 1945 - E.H.G

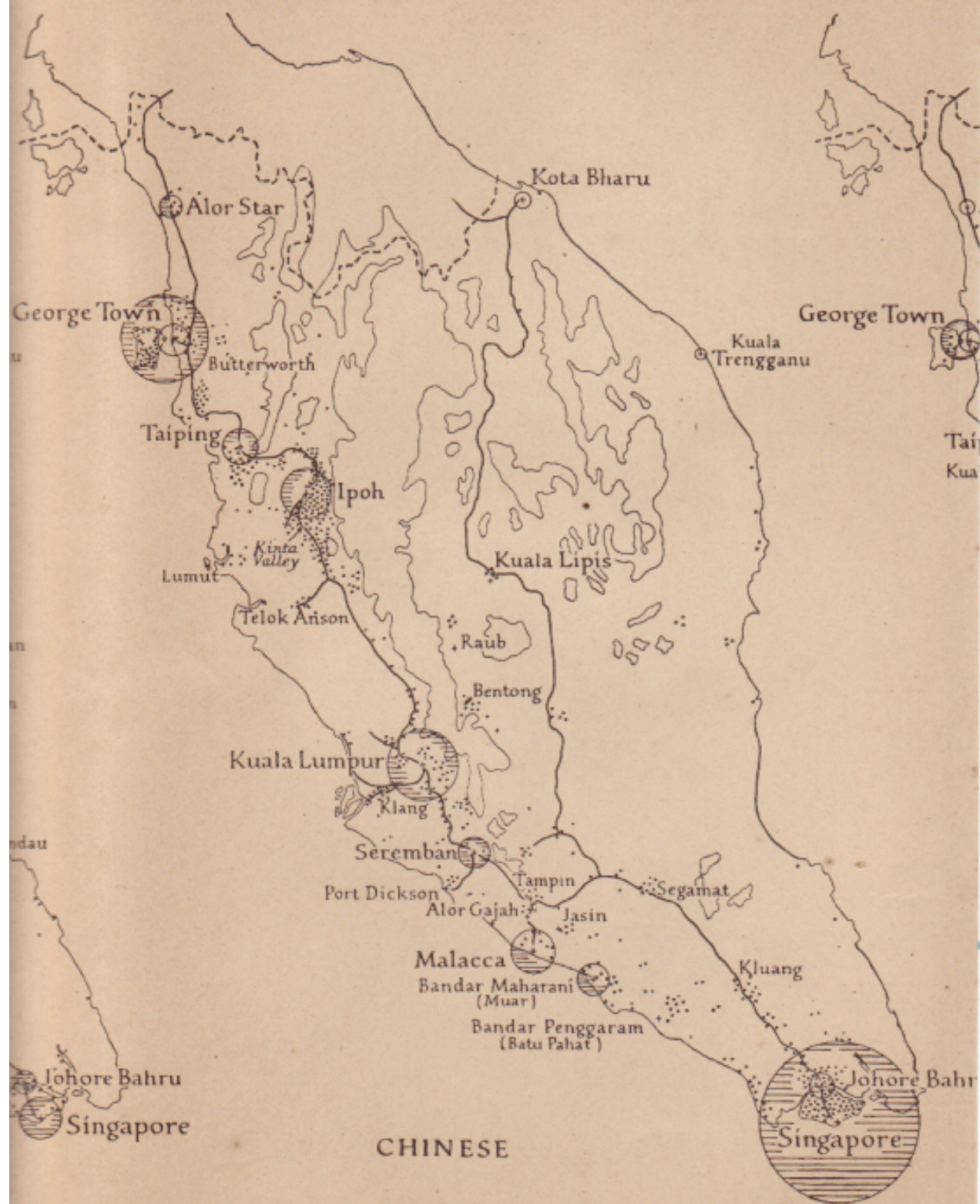
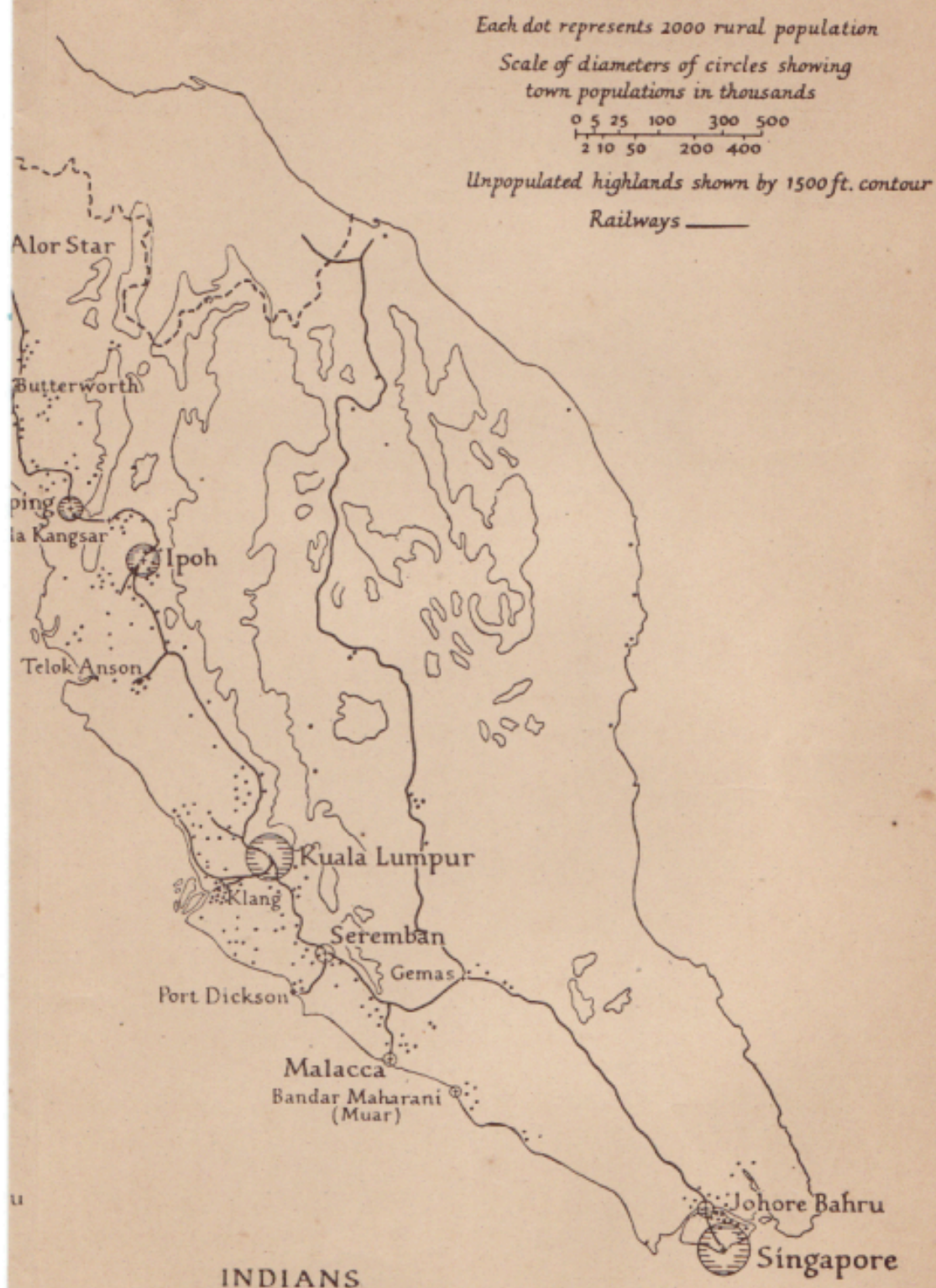


FIG. E.

Dobby



from Dobby, E. H. G.: Some Aspects of Human Ecology in Southeast Asia.

Geographical Journal, 1946

dominant trees are Dipterocarps, associated with such broad-leaved trees as *Garcinia*, *Artocarpus*, *Sapotaceae*, *Meliaceae*, *Burseraceae*, *Leguminosae*, etc. Above 3000ft., the Dipterocarps tend to disappear, and Oaks, *Myrtaceae* and certain conifers predominate.

A striking feature of the landscape in the northern half of the Peninsula is the appearance of low, but abrupt limestone hills, which bear a different flora, with smaller trees and shrubs and often with many *Gesnerads*, from that of the surrounding lowlands.

Much of the forest on the alluvial plains on the western side of the central mountain mass has long since disappeared and its place taken by rubber, rice, and other crops. The uniformity of these areas of cultivation, especially of rubber, is in striking contrast to the extraordinary diversity of the jungle, with its multiplicity of species, and the almost entire absence of gregarious forest. Unfortunately, the traveller by road or rail from Singapore to Penang passes through little or no virgin forest, but it can be seen in the distance as a dense and unbroken cover on the hills.

The clearing of land for cultivation has allowed many alien plants to establish themselves firmly, and some of the commonest and most conspicuous weeds of waste or cultivated ground, as well as the most obnoxious, are foreign to the flora. Nearly all the comparatively few *Composites* here, for instance, have followed man and his destruction of the forests. The native species are often quite large forest trees.

Where the original forest has been felled, and the land so cleared has not been cultivated, or has been allowed to revert to a wild state, secondary forest makes its appearance. This forest is easily distinguished from the original covering by its lower height, its denseness, its many creepers and light-loving plants, and the absence of the large trees of virgin forest. Gradually, this dense ground cover affords sufficient shade for the germination and growth of these large trees, and in time, perhaps a very long time, the original type of forest will re-establish itself.

Mangrove forest (of *Rhizophora spp.* and *Bruguiera spp.*) is extensively developed along the western shores of Malaya, where there is no surf to disturb the seedlings, and where the calm seas allow the mud and silt brought down by the rivers to form banks where the pioneer species may establish themselves. The west coast mangroves extend from Kedah to Singapore in an almost unbroken belt, in some places as much twelve miles broad. On the east coast, on the other hand, mangrove develops only in sheltered bays and in river mouths, and it is replaced by a narrow belt of *Casuarina* just behind the sandy beaches.

Mangrove trees require salt water, but in some parts of the country, notably in Eastern Johore, there are large areas of fresh water swamp forest where many trees of other species develop the stilt-rooted habit so characteristic of mangrove. This fresh water

swamp forest resembles that of the peat swamps of Central Johore, but there are differences in the composition of the forests on these formations.

The Malayan flora is that of the Sunda shelf—an area including Sumatra, the Malay Peninsula, Java and Borneo, and over which the flora is rather uniform. But traces of other floras can be detected, particularly those which have come in from the monsoon areas of Burma and Siam, and penetrated into the north of Malaya, where the seasons are more pronounced than further south; and those from the Himalayas and South China, which appear in the mountains, where the Sanicle and the Violet, Rhododendrons and trees of the Magnolia family are to be found; and those from the south, such as Agathis, Casuarina and Leptospermum, which have worked their way westward from Australia.

MALAYAN CRABS

(by M. W. F. Tweedie)

Like most elements of the tropical fauna the crabs are represented by such a great number of species that it is difficult to give an account of them which shall be both informative and brief.

The greatest variety is probably to be found on the coral reefs. Here the Xanthidae are dominant. The large pink *Atergatis integerrimus* is very common: various species of *Actaea* and *Carpilodes*, elegantly sculptured and brightly coloured, refute the opinion that crabs are all ugly creatures; the densely hairy *Pilumnus vespertilio* will be one of the first species collected and others of the genus, taxonomically "difficult" beyond all other Xanthids are always present. Swimming crabs of the genus *Thalamita* are also abundant and small Sponge Crabs (*Cryptodromia*) by no means rare. The reefs near Singapore Island have a rich fauna, but the clear waters of the South China Sea are more suited to the growth of coral and the most luxuriant and zoologically rewarding reefs in Malayan waters are those around the islands off the East Coast.

The sandy shores also support a great variety of crabs. Above the tide the amazingly swift Sand crab or Ghost crab (*Ocypoda ceratophthalma*) lives in deep burrows. Between tide-marks the little spider-like *Scopimera* trace their delicate pattern of sand pellets and scurry to their burrows at the slightest alarm. If a visit is made at low tide and the contents of a seine net or "pukat" can be inspected a great variety of crabs will be found among the tumbled mass of fish, prawns, mantis-shrimps etc. Here the swimming crabs (*Portunidae*) are most abundant and *Charybdis* the most varied genus. *Portunus pelagicus* is extremely common and is one of the two species (both Portunids) which are taken for food. The handsome Paddle Crabs (*Matuta*) are often present, and a host of others, Xanthids, the beautiful Porcelain Crabs (*Leucosiidae*) and the fantastic Mask Crabs (*Dorippe*) which hold a leaf or a shell

on their backs and have a remarkable likeness of a human face impressed on their carapace, are often found.

It is an interesting fact that the variety of animals taken in the seine nets is far greater during the South West Monsoon (roughly corresponding to the Northern summer) than during the North East Monsoon which brings us our rough weather. An obvious explanation of this is that the increased wave action drives all but the hardiest animals into deeper and more tranquil waters.

If the sandy beach is followed towards a river mouth it becomes more muddy and Ocypodid crabs begin to appear, among them the stalk-eyed *Macrophthalmus* and the extraordinary Calling Crabs (*Uca*.) The males have one claw enormously enlarged and usually brightly coloured and it is solemnly brandished aloft as an allurement to the female or a defiance to rival males.

Soon we come to the mangrove swamp which is a world of its own constituted of deep, tenacious mud, tangled roots and branches and myriad stinging midges. Here the Grapsid and Ocypodid crabs hold sway, the latter mainly in the soft deep mud near the water and the former among the mangrove roots; an interesting ecological succession can be observed from the almost liquid mud at the water's edge at low tide, which will support only the smallest forms (*Ilyoplax* etc) through grades of stiffer mud with *Uca* and *Metaplex* to the tangle of roots with *Metopograpsus* and the swift and wary *Sesarma*.

For the seeker for "new species" the mangrove is the most productive ground. Regional differentiation (e.g. between the east and west coasts of the Malay Peninsula) is very marked, the variety of forms hardly inferior to that on the coral reefs and the unattractive nature of mangrove considered as a collecting ground has led to its being avoided. He is an unlucky or faint hearted collector who cannot find a new *Sesarma* in mangrove in a hitherto neglected region.

The creeks running through the mangrove are the habitat of our chief edible crab, *Scylla serrata*. This large portunid is deep brown when alive and red after cooking. It is fished for with small shallow nets on a cruciform frame which are baited and suspended on an apparatus like a crude rod and line. If this is placed on the bottom and raised suddenly after a suitable interval the crab can be swung ashore before it has time to collect its thoughts and scramble off the net.

Lobsters, Prawns etc. Three lobsters, *Panulirus ornatus*, (Fabr.), *Scyllarus tuberculatus* (Bate) and *Themys orientalis* (Fabr.) occur in these waters, and the prawn and shrimp fauna is rich including *Penaeus* spp., *Metapenaeus* spp., *Palaeomon* sp., *Squilla* spp. and *Aceter* sp.

MOLLUSCA

The molluscan fauna is rich. The cephalopods are, of course, of considerable importance; there are many representatives of such forms as *Loligo*, *Octopus*, *Nautilus* etc. and they are economically of great value. Lamellibranchs of very many groups, such as *Arce*, *Cardium*, *Mytilus*, *Ostrea*, *Pecten* and *Trochus* are common and of economic importance for eating, and for the manufacture of shell products. Similar importance attaches to Gastropods such as *Haliotis*, *Murex*, *Patella*, *Pinctada* and *Turbo*.

THE FISH FAUNA

(by Tham Akow).

The fish fauna of Malaya consists of over 1000 species of Bony fishes as well as Elasmobranchs and it is possible to give here only a very general picture. For more detailed information Fowler (1938) may be consulted. For the purposes of description the fish fauna may be divided into two categories, viz:-

(1) Freshwater fauna: which includes fishes found in the ponds, lakes and rivers, and (2) Marine fauna: which includes those found in the sea as well as estuaries where the water is brackish.

Freshwater fauna.

The river and lake fish fauna includes species of Clariidae, Pangasiidae, Cobitae, Anabantidae, Channidae and Cyprinidae. Of the Cyprinidae more than seventy species are known including *Rasbora* spp., *Barbus* spp., *Crossocheilus* spp., *Dangila* spp., *Labeo* spp., *Lissocheilus* spp., and *Osteocheilus* spp. They are all wild and although some of them may be found in ponds their occurrence is only incidental.

Among the species used in pond culture are (1) *Trichogaster pectoralis* Regan, (2) *Osphronemus goramy* Lacepede, (3) *Helostoma temminckii* Cuvier, (4) *Cyprinus carpio* Linnaeus, (5) *Ctenopharyngodon idellus* (Val.) (6) *Aristichthys nobilis* (Richardson), (7) *Hypophthalmichthys molitrix* (Val.) and (8) *Tilapia mossambica* Peters. Numbers (5), (6) and (7) do not breed in Malaya and the fry have to be imported from China.

Marine fauna.

The marine habitat may be divided into two zones, inshore including the estuaries and offshore. The inshore zone is characterized by a very large number of species most of which do not grow to a large size and is also the nursery grounds of these as well as some species inhabiting the offshore zone. Most of the inshore species are euryhaline and invade the estuaries. Those of the offshore zone grow to a large size. There is however, no distinct line of demarcation and during certain seasons many offshore species migrate into the inshore zone.

Hypophthalmichthys nobilis

Red Sea

Black

Blue

Cyprinus Carpio
 Tenoshaen yodon Idellius
 Carassius auratus



CHOW HU



LEE KOH



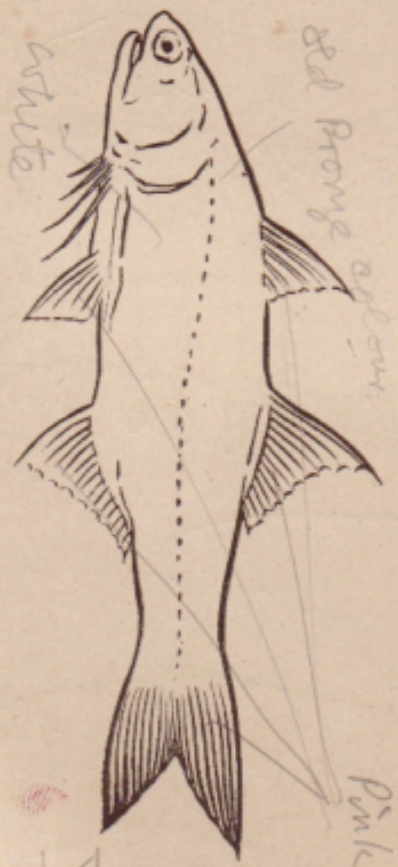
BILIS



TWA TOW



SOTONG



KURAU

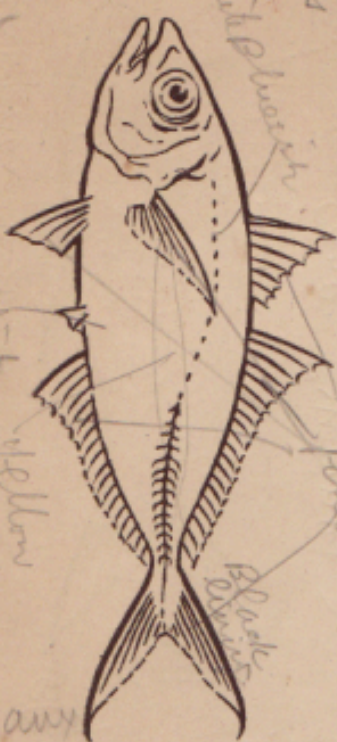


TONGKOL

Ikan
 Munny
 alletoratus

Thread Fin
 Polyremus
 Indicus

Grouper
Rock Fish
Epinephelus Corallicola

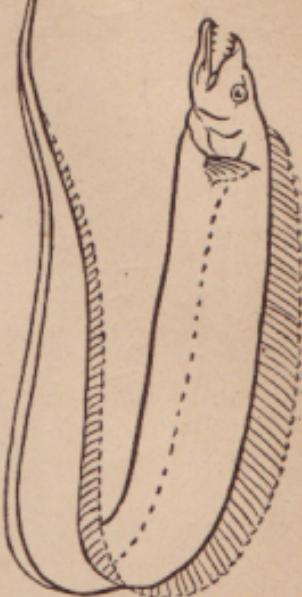


SELAR

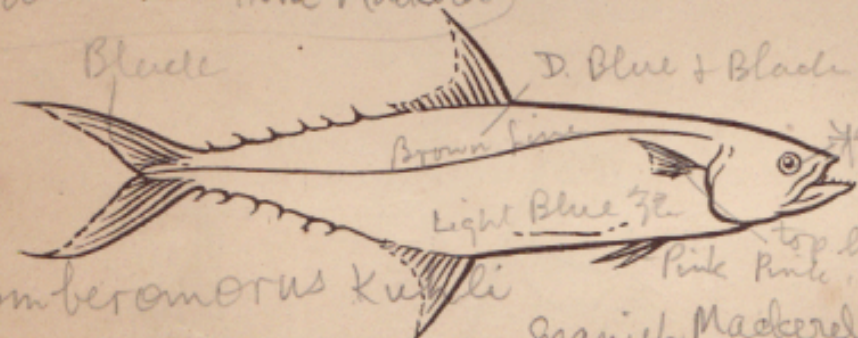
Horse Mackerel



KERAPU



SELAYUR



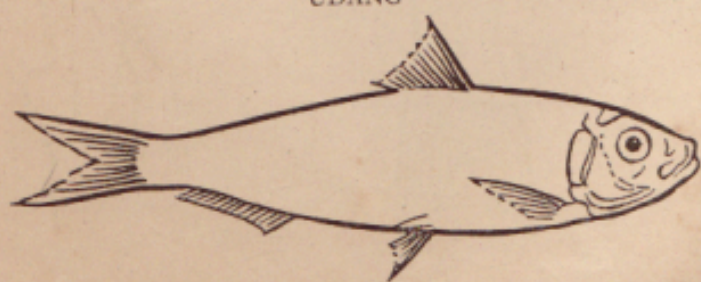
comberomorus Kuppili

Spanish Mackerel

TENGGIRI



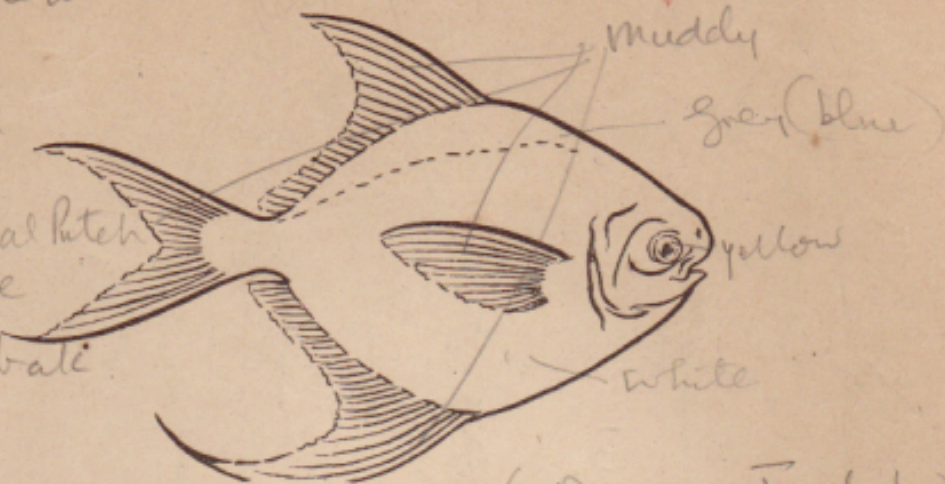
UDANG



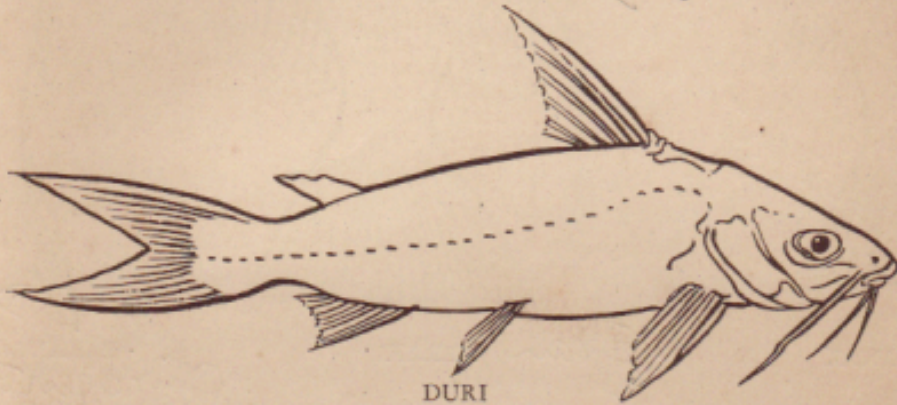
YU

White Pomfret
Stromateus Cinerus

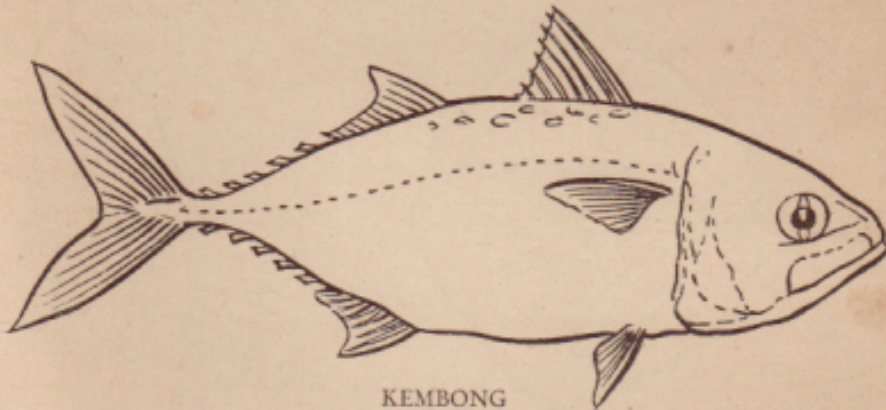
The smaller ones are called Bawal Puteh and the large Bawal Tambak



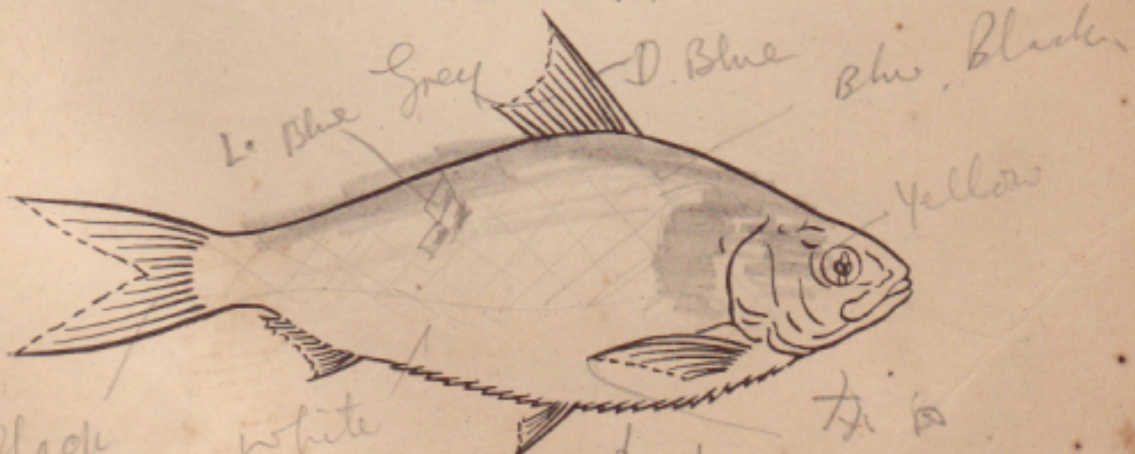
BAWAL PUTEH (Bawal Tambak)



DURI



KEMBONG



TERUBOK

shad
 Clupea Toli

Red Snapper
Lutjanus Argentimaculatus

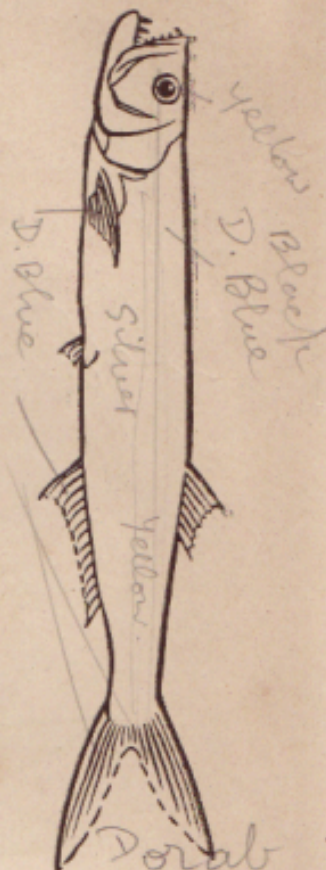


Grey Mullet
Mugil Labiosus

BELANAK



Ikan MERAH



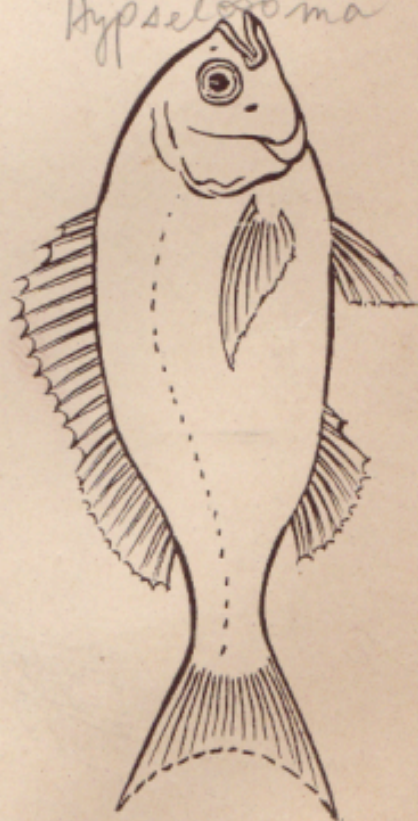
PARANG-PARANG
Chirocentrus hypselopterus



PARI



SABELAH



EKOR KOENING

In the inshore zone the Clupeidae, Mugilidae, Soleidae, Apogonidae, Lutianidae, Theraponidae, Carangidae, Leiognathidae, Labridae, Chaetodontidae, Pomacentridae, Scorpaenidae, Eleotridae, Gobiidae, Monacanthidae and Tetrodontidae are represented by many species. The Synodontidae, Muraenesocidae, Fistulariidae, Syngnathidae, Belonidae, Hemirhamphidae, Sphyrnidae, Atherinidae, Lobotidae, and Mullidae are represented by comparatively fewer species. In general each species is represented by comparatively few individuals except during certain seasons when species of Clupeidae, Carangidae, and Leiognathidae are found in very large numbers. Most of the smaller species are only used as pig and duck food e.g. Apogonidae, Scorpaenidae, Gobiidae, Fistulariidae and Syngnathidae, whilst Tetrodontidae are known to be very poisonous. The Theraponidae, Labridae, Chaetodontidae, Pomacentridae, Monacanthidae, Synodontidae, Hemirhamphidae and Atherinidae are eaten by the poorer classes but are not generally relished. The Clupeidae, Mugilidae, Lutianidae and Leiognathidae are, however, liked by the Asian population even though they may be small and bony.

The offshore fauna can be roughly divided into two groups:- demersal and pelagic. The demersal group consists mainly of the larger species of Lutianidae, Serranidae, Sciaenidae and Lethrinidae. The pelagic group consists mainly of species of Clupeidae, Carangidae, Scombridae and Trichiuridae, all of which are represented by large numbers. Both the demersal and pelagic groups form the basis of the more successful fishery methods in Malaya.

THE PLANKTON

(by Tham Akow).

The plankton of Malayan seas is similar to that of the Java Sea an account of which has been given by Delsman (1939). As in other parts of the world different species or genera predominate in the plankton at different times of the year.

The phyto-plankton is dominated by the diatoms represented by the genera *Coscinodiscus*, *Hemidiscus*, *Bacteriastrum*, *Planktoniella*, *Biddulphia*, *Chaetoceras*, *Rhizosolenia*, *Ditylimum*, *Thalassiothrix*, *Nitzschia* and some pennate forms like *Pleurosigma*. Tintinnids, *Ceratium* and *Noctiluca* are also present in the Plankton. Occasionally *Trichodesmium* is abundant.

The zoo-plankton is represented by the Coelenterata, the planktonic stages of the Polychaeta, Echinodermata, and Mollusca, the Chaetognatha, the Crustacea, the Tunicata as well as planktonic fish eggs and larvae. Generally it is dominated by the copepods in numbers, although like the other members of the zoo-plankton there are fluctuations in density. The Crustacea is mainly represented by the Copepods and Decapod larvae. The other subdivisions of this class are also represented e.g., Cladocerans, Ostracods, Cirripede larvae, Amphipods, Mysids and Stomatopod larvae.

MARINE REPTILES

(by M. W. F. Tweedie).

The four Indo-Pacific pelagic turtles have all been taken on the Malayan coasts. The Green Turtle (*Chelonia mydas*) breeds on the sandy shores of the east coast and its islands, but exploitation of the eggs does not form a local industry on the scale which it does, for example, in Sarawak. The Hawkskill (*Eretmochelys imbricata*) is not uncommon. Before the war the manufacture of ornaments from the "shell" was in the hands of Japanese in Singapore. The occurrence of the other two, the Loggerhead (*Caretta caretta*) and the Leathery Turtle (*Dermochelys coriacea*) is rare and casual.

The Estuarine Crocodile (*Crocodilus porosus*) may be found wherever there is extensive mangrove swamp and often ventures into the open sea to make its way from one river mouth to another. It is persistently hunted and shot and large specimens have become rare.

The Sea Snakes (Hydrophiidae) are very numerous. Twenty species have been recorded, about half of which belong to the genus *Hydrophis*. They are all venomous and the venom of the commonest species, *Enhydrina schistosa*, has been shown to be extremely toxic, far more so than that of the cobra. Human casualties, however, are rare though when they occur they are likely to be fatal. The snakes are not known to attack bathers, and fishermen who catch them in their nets are practically the only people who ever get bitten.

Almost all the sea snakes are viviparous, the young being active and well able to take care of themselves from the moment of birth, but one species, *Laticauda colubrina*, comes ashore to lay eggs.

THE COASTAL BIRDS

(C. A. Gibson-Hill).

The Malay Peninsula, like nearly all mainlands in the tropical zone, has a poor sea-bird fauna. Only three species, all terns, breed on the coast or off-lying islands. One, the Blacknaped Tern, *Sterna sumatrana*, occurs widely in small numbers along both sides of the Peninsula where there are suitable rocky outcrops or stacks to provide nesting sites. A second, the Roseate Tern, *Sterna dougallii*, is definitely scarce, and at present only two nesting sites are known, each harbouring about 5 pairs in July 1948. The third species, the Bridled Tern, *Sterna anaethetus*, is more plentiful again, but it is largely confined to the east side of the Peninsula; one small colony of 5-6 pairs is known from an island off Perak, while in July 1948 there were about 3,000 pairs breeding on stacks and islets off the east coast from Pulau Yu north to the Redang Islands (Gibson-Hill, 1949). The Bridled Tern generally favours rather bluer water for its feeding, and its preference for the east coast is understandable. With it may be taken the nature and distribution of the immigrant terns, all of which are largely estuarine or inshore feeders, and, so

far as is known, most plentiful off the west and south coasts of our area.

The other groups of sea birds are represented solely by visitors or strays. The only booby known from our area, the Brown Booby, *Sula leucogaster*, which breeds on the Aroa Islands in the centre of the Straits of Malacca, and possibly on Pulau Perak (70 miles west of Penang Island), is merely an occasional visitor to Malayan waters, though it would seem to be fairly plentiful in the central sector of the Straits. There is only one authentic record of a tropic-bird, an immature Short-tailed Tropic-bird, *Phaethon aethereus*, taken by Dr. Cantor somewhere off Penang. The Least Frigate-bird, *Fregata ariel*, which breeds in the Anamba Islands, visits the most seaward portions of the Johore-Pahang Archipelago in some numbers. Further inshore it is only an occasional stray, known by a few specimens from Pahang round to Singapore, and again visually from the Langkawi Islands. The Common Noddy, *Anous stolidus*, which breeds in company with the Bridled Tern on Barren Island (between Singapore and Kuching) and in the Inner Gulf of Siam, has not yet been recorded from the east side of Malaya, and is known in our area only by five specimens taken in the northern half of the Straits of Malacca. To these birds may be added two storm-petrels. It seems probable that Wilson's Petrel, *Oceanites oceanicus*, occasionally strays over much the same area as the Noddy, while Swinhoe's Petrel, *Oceanodroma monorhis*, arrives annually in small numbers off the eastern end of the Singapore Strait, and has been recorded as far west as the One Fathom Bank Lighthouse.

Two common resident hawks take their food largely, or partly, from the sea and estuaries. One of these, the fine Whitebellied Sea-Eagle, *Haliaeetus leucogaster*, feeds mostly on fish or sea-snakes, taken from open water, and to a lesser extent from stakes and nets. It is widespread and fairly plentiful round the Malayan coast, and a few birds can usually be seen near any fishing kampong where there are suitable tall trees, other than palms, for them to rest and nest in. The other hawk, the Brahminy Kite, *Haliastur indus*, is much more of a scavenger; it also is present round most of the kampongs, but it feeds largely on floating offal, or on fish taken from the kelongs and the shore after the men have been working a seine. In addition to these birds two races of the Osprey, *Pandion haliaetus*, occur in small numbers as non-breeding visitors.

Six shore frequenting herons and storks are resident in Malaya, but only three of these, the Reef Heron, *Demigretta sacra*, the Dusky Grey Heron, *Ardea sumatrana*, and the Little Green Heron, *Butorides striatus*, are at all common. These birds occur widely round the coast, the first mostly on rocky shores and the last two largely among mangroves or on muddy ones. In these latter areas, and along the tidal portions of the estuaries, a single kingfisher, the white-collared *Halcyon chloris*, is both plentiful and extremely conspicuous. It feeds, curiously enough, largely on small crabs which it takes from

beaches and mud-flats left dry by the tide. The other kingfisher plentiful on the Malayan coasts is the Indian race of the Common Kingfisher, *Alcedo atthis*. It is found mostly in the neighbourhood of pools or standing water in the mangrove belt and behind it; as in other sections of its range it obtains the greater part of its food by dividing and lifting it from just under the surface of the water.

These birds, in broad outline, cover the extent of the sea birds and the more plentiful fish-eaters among the coastal species. In summary it may be said that the fauna is not very rich; the commoner sea birds are largely those of an inshore complex, rather than a blue water one, as one would expect from a study of the coast itself; such blue water birds as reach here are found mostly off the east coast, well out from the mainland, or in smaller numbers in the northern portion of the Straits of Malacca.

VI. THE FISHING PEOPLE AND THEIR VILLAGES.

The official estimates state that there were some 44,379 people engaged in fishing in this area in 1947. Table 1, page 54, shows the distribution of this total among the various states and also its racial composition. These distributional and compositional features correspond roughly with similar features of the entire population. It is in Perak, Selangor and Negri Sembilan that the Chinese outnumbered the Malays; in other States the Malays were in majority and there were only Malays in Trengganu and Kelantan. The racial groups do not mix in the villages.

The figures given in Table 1 relate only to men (and a few women) actually engaged in fishing, and do not include any engaged in subsidiary, related industry, or dependents. Nor do these figures indicate the relative numbers of those engaged in different occupations within the industry. Firth (1946) in describing a sample Malayan fishing community in Kelantan State, gives tables showing the distribution of population. Of a total of 1301 persons, 411 (31.6%) were males of age above 15 and likely to be engaged. The primary occupation of 401 of these males is classified by Firth, showing 307 (76.6%) as fishermen and 32 as dealers in fish etc.; of the remaining 62, only two, who were boat builders, might be regarded as being engaged in industry directly related to fishing, though doubtless the rest, with the exception of 7 retired, could be regarded as in the main servicing the fishermen. We may reverse the figures and say that 307 fishermen were accompanied by 85 employable males (27.7% of their number) and that the total employable population was accompanied by about 909 dependent children, females and aged males (about 2.3 times their number). These calculations might have approximate application to the figures for Malay fishermen shown in Table 1 and suggest a total Malay fishing population of about 140,000, but could not be applied to the figures for other nationalities.

The relative absence of individuals in occupations subsidiary to fishing (excepting fish-dealing) in the above instance described by Firth, is explained by the fact, characteristic of all primitive communities, that the individual fisherman is his own netmaker etc.. This is further shown by Firth's Table 4 (l.c. p.78) where an analysis is made of the secondary occupation of the employed persons; here it appears that about 20% of the fishermen have distinct secondary employment in the manufacture of gear and boats. This principle applies generally in the area and extends to the processing of fish by salting and drying and by cooking (see Chapter IX). Firth's table just referred to also shows that fishing, among the Malays at least is generally a part time occupation in so far as shore occupations engage part of their time; these shore occupations engaged in by people who are otherwise regarded as fishermen, include all the local rural pursuits such as rice planting, copra-making and so forth. Conversely, most individuals engaged in other occupations participate in fishing operations to some degree during each year. The alternative occupation of the fishermen is largely a consequence of the enforced vacation from fishing during the monsoon and partly an aspect of the organization of a primitive community. The fishing activity of the non-fishing individuals is among other things an indication of the importance of fish in their diet. It will be recognized that in the Malay fishing community, although the majority of the men are to be considered as 'professional' commercial fishermen, there is a large measure of the character of subsistence operations in all of their work.

Although the foregoing features are readily recognizable in the ordinary Malay fishing village on the Peninsula (the description of Chinese fishing villages is yet awaited) they are largely obliterated in the case of Singapore fishing villages. Here there is an intrusion of 'foreign' elements and an attraction away from the village of individuals of all age-groups and both sexes. This of course is no more than might be expected as a result of the growth of the city of Singapore and the extension of its influence by the improvement of roads and the means of travel.

The fishing villages are of two chief types. Along the east coast there is found the type of village, described by Firth (l.c. and 1943), which consists of attap huts and other structures strung in a series parallel to the coast among the palm trees just behind the beach (Plate 2). In other situations, notably in estuaries, the village is built on stilts over the mud-flat and mingling with the mangrove stand behind the mud-flat. Space does not permit an account of the layout of these villages, but reference is made to Firth (l.c. and 1943).

In the industry there are recognizable roughly four distinct categories of operative, which may be listed as follows:-

1. Specialists,
2. Leaders (Experts),
3. Crew-members,
4. Owner-operators.

The specialists are those individuals who specialize in the construction of *kelongs*; their methods of working, and the nature of their qualifications are described by Tham and Le Mare (1947). The experts on the other hand are those men who have specially trained in the operation of a type of gear and who organize and direct the operations of a team; Firth (1.c.) has given a detailed account of the training, qualifications and role of the expert in the use of the lift-net on the east coast. In other operations, such as the purse-seine and the beach-seine, there are similar leaders who are responsible for the direction of operations. As in fisheries in other parts of the world, these positions are taken by virtue of abilities, training, personality, physique and economic and social status, in varying combinations. Much of their intellectual equipment is empirical knowledge and traditional lore and there is no doubt that its application yields success. There is as yet little of formal navigational training, and mechanical knowledge is of course still scanty. The crew-members naturally include a range of qualifications. They are those who act as captains of boats in a fleet of craft operating a unit of equipment; these individuals have responsibility for direction of the crew in their charge, and for care of the boat and equipment. There are those who serve merely in paddling, and in handling the net under direction; also there are the 'attached' personnel who do the cooking for the crew. In all, this must be recognized as a group of individuals proficient in the operation of its established types of equipment, and competent as sea-faring folk. There seems little doubt that they will prove capable of acquiring such new techniques as may be demonstrated as suitable for the conditions and fish-stocks of the area, but it is a more difficult thing to attempt to predict the success of the psychological and economic adjustments which would be required by the adoption of the highly-capitalized and mechanized long-ranging operations out to deeper waters.

Fishing, as an occupation, is in some instances less arduous and and possibly less hazardous than the same occupation in other latitudes, but it should be remembered that these fishermen must endure extreme heat and that for their frail craft their voyages, although short, are attended by some measure of risk. The monsoon season is of course dangerous, but fishing generally ceases for the dangerous period. It is of course an uncertain occupation from which the earnings are generally not high. There is no security of any kind (save that offered by the primitive social conventions): mishaps must be borne and old-age provided against by the individual. There is practically no navigational code, nor any real precautions against mishap at sea, or organization to deal with such. There is of course no weather forecasting system, no life saving service, no insurance of life or property. Coupled with these conditions of employment is the lack of education; free education is provided for Malays by the state and in some instances the Chinese have a school associated with their club-house (or Council house) and financed by contributions in one form or another, e.g. a form of excise on ice at Pangkor; but

this is only elementary education. The Government recently established a small school for providing sons of fisherfolk with technical education in fisheries; apart from these instances the industry is ill-educated. Presumably as a consequence of all of this, the operatives occupy a very low position in the community. Their elevation will involve considerable effort requiring much thoughtful planning and careful consideration of socio-economic facts adduced by investigations such as those proposed by Firth (1948).

VII. METHODS OF FISHING

(by Tham Akow).

Although the expression 'methods of fishing' is used as a title to this section, its subject matter is wider than an account of methods: a brief description of the types of gear is given and the main types of fishing craft are also described.

There are in Malaya very many fishing methods, and for each method there is an almost unending variety of equipment. It may be suggested that the range of methods is primarily a consequence of the tremendous variety of species of fish (of which there are more than 1,000) and of the varied physiographic and other conditions in which they may be pursued; the range of types of equipment is an expression of the diverse cultures which have contributed, by migrating fishermen, to the fisheries technology of the region, and is also an expression of ingenuity in exploiting the local materials (bamboo etc.) for the construction of equipment.

In describing the fishing methods (and equipment) the capture operations are listed first and then the culture operations, and in both the methods of the principal ecological zones (fresh-, brackish- and marine-water) are separated; there are however no marine cultural operations. The marine capture operations are the most diverse and and claim most attention; for these methods the following system of classification is employed:-

A. Nets.

a. Moving:

1. Haul; seines, e.g. Tuabang, pukat tarek, pukat payang, pukat kisa.
2. Cast; jala.
3. Thrust; sundong, sungkor, rawa, siring.
4. Encircling; purse-seine, pukat jerut.
5. Drift; pukat hanyut, jaring hanyut, jaring pundi, pukat kurau, pukat senohong.

b. Stationary:

6. Set Gill; pukat dalam, pukat kedra, pukat terubok.

7. Set Barrier; amfang.
8. Lift; pukat tangkol.

B. Lines:

- a. Baited:
 9. Hand; e.g. plontang.
 10. Long; rawei; umpan.
- b. Non-baited:
 11. Troll lines with lures.

C. Traps:

- a. Simple movable: bubu.
- b. Complex, fixed: kelong, blat, jermal, ambai, blat pok.

D. Miscellaneous:

- a. Spears and harpoons: tirok, tempuling, serampang, julir.
- b. Dynamite.
- c. Poison: tuba root and Chinese tea-seed cake.

The majority of these methods are adapted for fishing in the inshore area out to the ten fathom line; the most notable exception is the purse-seine. Furthermore, the methods are characterized generally by the absence of mechanical power in their manipulation. Only comparatively elementary machines, with a very low mechanical advantage, such as windlasses and simple combinations of pulleys have been developed. Powered boats are used only as carrier- and mother vessels which give the fishing units a wider range of operation.

The geographic location of the industry employing each of these methods is chiefly a matter of physiography etc.; certain types, such as the haul seines are somewhat ubiquitous; so also is the cast net and the hand-line. The lift net (pukat tangkol) is found on the east coast; the purse seine on the west coast around the Dindings in particular. The kelong is found on Singapore island and in Johore. Table 1 gives figures of the numbers of units of the main types in each of the States.

Capture Methods

In Fresh water.

The methods of the capture of freshwater fish in ponds and rivers are simple. They consist mainly of portable traps of rattan and bamboo, commonly known as *bubu*, with one or more compartments. Entrances are provided so that the fish may enter the trap easily and pass readily from one compartment to the next until it reaches the last one from which it would find exit difficult. Small seine nets are used. They are about 60 feet long and 3 to 4 feet

deep. Cast nets also are used. In some of the larger rivers small fishing stakes similar to the *Blats* are used. These will be described under the Marine section.

In Brackish water.

In brackish water the methods employed for the capture of fish and crustacea are just as simple. In brackish water ponds a simple fine-meshed bag-net is fixed a teak sluice gate and the shrimps, prawns and fish are all washed into the bag. For catching crabs a simple contrivance known as the *bintob* is used. It consists of a framework of two crossed pieces of rattan each bent into a half circle and covered with coarse netting (3 to 4 inch mesh). A long pole is lashed to it so that it looks very much like an inverted umbrella. This is pushed into the bottom of the brackish water ponds with the bait (shark meat) tied to the inside of the apex of the inverted framework. It is lifted out of the water at intervals and the crab will be caught trying desperately to free itself from the netting. *Bubus* and cast nets are also used at times for catching fish in brackish water.

In Marine water.

A (a) Moving Nets.

(1). Haul Seines. (Plates 7 and 8)

Under this head are included various modifications. The largest type is that worked by Chinese in Singapore. It is known as the "*Tuabang*". The net consists of a roughly cone-shaped bag of netting with long wings. The bag is about 20 feet long with graduated mesh, from $\frac{3}{4}$ " stretched mesh at the tip or apex of the cone to $1\frac{1}{4}$ " stretched mesh at the mouth of the bag. Each wing consists of a wall of netting 500 feet long at the end of which is attached a rattan lead about 2,500 feet long. The depth of the net near the mouth is about 36 feet and decreases gradually along each wing to about 9 feet at the junction of the netting with the rattan leads. The mesh of the wing netting increases from $1\frac{1}{4}$ " stretched mesh near the mouth of the bag to $2\frac{1}{2}$ " stretched mesh at the extremity of the wings. The rattan lead is made by plaiting together about five strands of rattan of about $\frac{1}{2}$ " diameter. Three sizes of cotton twine, viz., No. 6, 9 and 12 are used to make up the net. The head line consists of two pieces of Manila rope of $\frac{7}{16}$ " diameter between which all the floats are sandwiched. The floats are made of light wood and the distance between two adjacent ones varies from 1' 2" to 2' 6". The foot rope consists of two pieces of Manila rope,—one of $\frac{7}{16}$ " in diameter and the other $\frac{3}{4}$ " in diameter. Weights are sandwiched between the two pieces of foot rope at a uniform distance of 1 foot apart. They consist of ellipsoidal pieces of sandstone with a circular hole. The net is worked by 15 or 16 men and is shot from a wooden rowing boat 35' long, 5' wide at the centre and 2' deep.

As in all other haul seines the net is shot from a stationary point on the beach and the boat is rowed as rapidly as possible in a sea-

ward direction, paying out the net at the same time more or less in a semi-circle and ending up at another point further along the beach. When this is done the hauling operation starts,—the fishermen dividing into two groups, each hauling on one lead. Meanwhile the headman of the team rows out in the boat and stations himself somewhere near the bag, lifting up the float line when necessary to prevent the fish from leaping over. When the bag is hauled in, the fish are dropped into the boat and sorted, whilst the net is properly stowed for the next operation. Fishing operations usually begin when the tide is at half ebb and stops when the tide is at half flood.

This method taps the whole of the inshore fauna as well as some migratory forms and anything up to 200 species may be represented in any one haul. Members of the sub-order Clupeoidea of the order Isopondyli, the orders Percomorphi and Plectognathi are well represented in the catch. The bulk of the catch consists of fishes fit only for pig and duck food. During certain seasons, however, when the more popular types of food fishes like the anchovy (*Stolephorus spp.*), the dorab (*Chrocentrus dorab*), the mackerel (*Scomber spp.*) and the horse mackerels (*Carangidae*) abound in the inshore waters of Malaya, very valuable catches are obtainable.

There are many other modifications of this method of fishing. In Penang and Perak the Tamils use a net of about the same dimensions except that the meshes of the wings are much larger. All along the coast of Malaya smaller forms of the haul seine known as *Pukat Tarek* are operated by 3 to 5 men, both Chinese and Malays. Yet another modification is the *Pukat Kisa* which is generally operated by 2 men.

There is one method similar to the Danish Seine which is operated in deep water of 15 to 20 fathoms off the East Coast of Malaya. It is known as the *Pukat Payang*. The peculiar feature of this method is that the leader of the fishing team locates the fish and gauges the size of the shoal as well as the direction in which it is moving by submerging his whole body into the water and listening to the sounds made by the fish. The crew consists of about 18 men operating from a special type of boat, the *perahu payang*. Sciaenids and Carangids are the main types of fish caught.

(2). Cast Nets.

The cast net that is commonly used by individual fishermen as well as peasants is a very simple affair. It is a circular net of cotton thread with a string attached to the centre of the circle and small weights or metal chain attached along the circumference of the net. This is owned by almost every fisherman and is used to procure sufficient fish for the family when adverse weather keeps the fishermen from venturing out to sea. (See Plate 7).

(3). Push Nets.

The push net is in general use in the intertidal areas of Malaya and Singapore. It consists of two light poles from 10 to 15 feet in length crossed at a point about two feet from the thicker ends. The more slender ends of the poles are each fitted with a shoe-like gadget made of cocoanut husk to facilitate the pushing operation. The fine-meshed scoop-like net is fastened to the longer arms so that the bag end is nearest to the fisherman and he stands in waist-deep water with the shorter arms gripping his waist so that the point where both poles cross is just in front of him. He grips the longer arms of each pole with each hand at a point about 18" from the point of intersection of the poles. To begin operations he lowers the poles so that the 'shoes' touch the sea bed and pushes the net slowly along the sea floor. After awhile he lifts the poles using his waist as a fulcrum and shakes the catch into the smaller baglike end of the net. The catch is then thrown into a basket fastened to his waist by a piece of rope. This basket is kept afloat by means of two bamboo floats attached to its bottom and floats behind him as he pushes his net along. The main catch consists of a small shrimp known as Grago (*Acetes spp.*) during certain seasons and prawns (*Peneidae*) at other times. In Malaya several types of push nets are in use, viz:- Sundong, Sungkor, Rawa and Siring, but they all work on the same principle. (See Plate 6).

(4). Purse Seine.

The purse seine in Malaya was introduced by Chinese from Hainan and Pakhoi in South China more than twenty years ago. It consists of a huge wall of netting about 160 fathoms long and 25 to 35 fathoms deep. The whole net is made of cotton twine of 1" stretched mesh, excepting the centre bit which is of ramie twine of the same mesh. This is so because this centre piece has to take the weight of the whole catch when the net is hauled in to transfer the catch into the boat. The head line is provided with wooden floats about 8" long, about 3" wide, tapering to truncate ends, and about 1" thick. The foot rope is fitted with brass rings at regular intervals. Each ring is fastened with a clove hitch the free ends of which are passed through a hole which runs through the axis of a cylindrical piece of lead, and are then fastened to the foot rope. Two brass rings with swivels are fastened to that part of the foot rope immediately below the centre of the net and the purse ropes are fastened to these two rings and then passed through the other rings attached to the foot ropes.

The crew consists of a headman, two fish watchers, two fishing helmsmen and fourteen fishermen. The net is stowed in two sampans so that half of the net is in each sampan. These sampans are put on one side of a powered fish carrier which is provided with a crow's nest. This method of fishing depends on the fact that shoals of *Kembong* (*Scomber sp.*) near the surface or a little way below it give off a luminescent glow. It will be obvious that fish-

ing will be restricted to the darker nights of the month i.e. say from the 20th. day of the lunar calendar month to the 10th day of the following month. When the unit arrives at the fishing ground, one fish watcher perches himself on the crow's nest to look for shoals of fish. When one is spotted the powered vessel is manoeuvred into position and the two sampans are then released. Very often the helm is taken over by the headman as soon as the shoal is spotted. The crew of each sampan consists of one fishing helmsmen and seven fishermen. The headman orders the launching of the sampans at the opportune moment and the sampans are then propelled along with a long oar worked by four members of the crew while the other four pay out their portion of the net. It is surprising how rapidly the sampan can be propelled. As soon as the two boats meet after encircling the shoal the pursing operation begins and the water at the point of pursing is beaten with two large stones to scare the fish away from that point. Meanwhile the powered boat approaches and as soon as the pursing operation is complete the net is hauled towards the carrier and the fish transferred into it by means of large rattan baskets.

The units leave the fishing village before sunset and begin operations soon after sunset. They return at first light the next morning or a bit later if they have to go far from the base. The main fish caught by this method is the mackerel (*Scomber sp.*) known as *kembong*. Sometimes Carangids (*Megalaspis cordyla*) may be caught and even species of *Leiognathus* have been caught in large numbers occasionally. This method of fishing is practised mainly at Pangkor in Perak and in Kedah. The units are either all Chinese or all Malay. The foregoing account relates to the Chinese gear; the Malay gear differs by having a smaller net which is stowed on one boat.

(5). Drift Nets.

There are many types of drift nets in use in Malaya. They all work on the same principle but the meshes differ with the types of fish which they expect to catch.

In the case of the most common type of drift net known as *Pukat banyut* or *Jaring banyut* several pieces of drift netting are joined together to form a complete net. The number of pieces used depends on the fisherman himself. Some use seven pieces whilst others use up to ten pieces. Each piece is about 15 fathoms long and $4\frac{1}{2}$ fathoms deep, with wooden floats attached to the head line at intervals of about 20". The netting is of ramie fibre and the mesh varies from $2\frac{1}{2}$ " to $3\frac{1}{2}$ " stretched. This type of drift net is used mainly for catching the Spanish mackerel (*Scomber spp.*), the dorab (*Chirocentrus dorab*) and the pomfret (*Stromateus spp.*). The net is preserved with cutch or a mixture of Tung oil and white of egg. In the latter case the net is whitish in colour and can also be used during moonlight nights.

There is another modification in which one of the 7 pieces of netting is preserved with the Tung oil - egg mixture whilst the other six are preserved with cutch. The pieces are arranged so that the whitish piece has three dark pieces on each side of it. This modification is known as *Jaring pundi* and is set in the shape of the letter 'V' usually with the arms of the letter 'V' against the tide. The boat is then tied to the angle of the net and the whole net drifts along. Fish swimming with the tide come up against the dark pieces of netting and proceed along it until they dash into the whitish centre piece. This modification can also be operated in the daytime.

Another important modification is the submerged drift net which is used in the Straits of Malacca to catch the shad (*Hilsa spp.*) known as *Terubok*. The net is submerged to the desired depth by means of weights attached to the foot rope. For catching the large Polynemids known as Kurau, the *Pukat Kurau* or *Pukat Senobong* is used.

A(b) Stationary Nets.

(6) Set Gill Nets.

Among the many types of set gill nets in use in Malaya are the *Pukat Dalam* used for catching the small Mackerel off the East Coast, the *Pukat Kedra* used for catching a small mullet off the West Coast and the *Pukat Terubok* for the shad.

There are various sizes of *Pukat Kedra*. The large ones are 150 fathoms long and $2\frac{1}{2}$ to 3 fathoms deep. Cylindrical floats about $2\frac{1}{4}$ " long and $2\frac{1}{2}$ " diameter are used. The fish are encircled with the net and the water is then splashed to frighten the fish which dash into the netting and are gilled. The *Pukat Terubok* is operated on the same principle. The whole net is made up of 16 pieces and is operated by about 26 Malay fishermen. Each piece is about 30 fathoms long and 8 fathoms deep. Somewhat larger cylindrical floats ($3\frac{1}{2}$ " long and 3" diameter) are used. The *Pukat Dalam* is about 100 fathoms long about 15 fathoms deep.

(7) Set Barrier Nets.

The usual type of set barrier nets used in Malaya is known as the *ampang*. It consists of a wall of netting set up by means of poles stuck into the sea bed. The length varies from 100 fathoms to 400 fathoms and the depth from 4 to 5 feet. The size of the mesh is about 1" stretched. It is set at high tide and the fish which are stranded at the net are collected at low tide.

(8) Lift Nets.

The most widely used type of lift net is the *Pukat Tangkol*. On the East Coast of Malaya the net consists of a piece of netting about 150' square with the mesh increasing in size from the centre outwards. It is operated from 5 native boats. A lure consisting

FISHING GEAR AND BOATS LICENSED AND FISHERMEN EMPLOYED IN THE FEDERATION OF MALAYA AND SINGAPORE, 1947.

	Perlis	Kedah	Penang	Perak	Selangor	Negri Sembilan	Malacca	Johore	Pahang	Trengganu	Kelantan	Singapore	Total
Haul seines.	8	447	195	130	74	11	1	128	69	221	111	50	1445
Pukat Payang.	2	10	12	8	—	—	—	4	8	30	33	—	107
Purse seine.	4	10	—	28	—	—	—	13	—	1	—	—	56
Other seine Nets.	88	203	55	18	66	13	—	—	5	—	21	—	469
Push Nets.	—	458	104	—	26	—	11	29	19	—	—	6	653
Drift Nets.	100	37	208	155	676	29	296	492	80	64	169	222	2528
Set Gill Nets.	2	3	71	1	3	—	—	11	7	56	21	—	175
Set Barrier Nets.	1	—	4	—	—	—	—	43	—	—	—	17	65
Lift Nets.	—	39	120	71	—	8	—	27	146	67	352	20	850
Long-lines. Baited	27	133	214	169	61	1	73	52	3	—	30	23	786
Long-lines. Unbaited.	—	3	25	5	10	—	2	—	4	—	—	49	—
Other lines.	—	—	—	—	4	—	—	—	7	—	638	400	1049
Traps. Kelongs.	—	—	—	—	37	—	—	—	—	1	4	254	805
" Blats.	135	117	47	64	18	17	15	235	49	12	—	30	739
" Jermal.	—	5	6	35	16	—	—	61	—	—	—	—	124
" Ambal.	—	—	126	216	265	1	—	87	—	—	—	—	695
" Blat Pok.	3	19	3	23	—	—	—	—	—	—	—	—	48
" Other Fishing	—	—	—	—	—	—	—	—	—	—	—	—	—
Stakes.	—	—	18	—	—	—	—	320	2	—	—	—	340
Bubu & Other traps.	—	—	46	45	3	—	2	84	40	262	1	102	585
Miscellaneous. Nets	—	—	—	—	—	—	—	—	—	—	—	—	—
Traps, etc.	—	632	325	207	183	25	1	48	—	3	12	203	1639
State Totals	370	2116	1579	1175	1442	105	401	2143	439	718	1392	1327	13207
Fishing Boats.	473	2905	2110	1271	1833	145	765	2594	547	2066	1392	1301	17402
Non-powered.	8	28	15	33	8	—	—	22	—	—	—	229	343
State Totals.	481	2933	2125	1304	1841	145	765	2616	547	2066	1392	1530	17745
Fishermen.	675	4079	2879	1422	674	156	1357	1839	1943	11053	7022	—	33099
Malays.	223	484	2168	2457	3362	166	643	1147	96	—	—	—	10746
Chinese.	—	64	319	71	29	6	4	—	—	—	—	—	488
Indians.	—	—	7	—	—	—	5	—	—	—	—	—	12
Portuguese	1	8	—	25	—	—	—	—	—	—	—	—	34
Siamese.	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals.	899	4635	5368	3975	4065	328	2009	2986	2039	11053	9022	—	44379

TABLE I

of several coconut fronds is anchored in the sea and its position is indicated by means of a long bamboo float. Marine organisms collect on the lure and small Carangids and Clupeoids collect around it. When sufficient fish has collected the net is set several hundred yards away from the lure in the direction of the tide, with one boat at each corner. The lure is then slowly moved towards the net by the remaining boat until the fish are immediately over the net when it is lifted and the fish scooped into the boats.

B. Lines.

(9) Hand-lines.

Hand line fishing is very widespread in Malaya as nearly every fisherman is a hand-liner. What he catches with a hand line is considered his own property. The size of hook used depends on the type of fish available. One interesting modification of the usual hand line is used to catch large dorab and mackerel. It is known as the *Plontang*. In this method a large hook is attached to the line by a piece of soft brass wire about 3 feet long. The line is suspended in the water from a long, somewhat cylindrical wooden float. In this way one fisherman can use from 20 to 30 floats. When a fish is on the line the float begins to bob up and down. In Singapore three types of fish are preferred as *Plontang* bait, viz:- *Clupea fimbriata*, *Clupea perforata* and *Dussumieria basselti*.

(10) Long lines.

Long line fishing is known as *Rawei* in Malaya. There are many variations in respect of the size and number of hooks, the length of the snoods, etc. They all, however, follow the same principle. A common type has the following specifications:-

- (1) Distance between points of attachment of snoods about 7 feet.
- (2) Length of snoods about 4 feet.
- (3) Size of hooks No. 7 mustard.
- (4) Number of hooks per set about 200.

Each set is packed in a flat round basket with the main line and snoods neatly coiled and the hooks stuck into the straw covered rim of the basket. The number of sets used depends on the strength of the fishing crew. Individual fishermen use from 1 to 3 sets.

(11) Troll lines.

Troll lines are used by fishermen when proceeding to or from the fishing grounds. They use white tape tied to the hook as a lure and during the Spanish mackerel season it is not unusual for each fisherman to land one or two large fish. Sometimes fairly large barracouda are caught.

C. Traps

In Singapore and South Johore the most common types of trap operated are the *kelong* and the *blat*. In the Straits of Malacca, where the currents are very strong, *jermals* and *ambais* are common. Between Selangor and Penang on the West Coast there are quite a few *Blat Siam* or *Blat Pok*.

a. Simple Movable Traps.

Bubu.

These are small traps of rattan or galvanized wire netting. They vary in size and shape. The marine type, in general, is box-shaped and has only one compartment.

b. Complex, Fixed Traps.

Kelong.

In the *Kelong* there are two enclosures and a long lead formed by sticking poles into the sea bed. Rattan screens with a rather wide mesh (8" square) are used. The special feature of this trap is the use of a light to attract the fish into the last blind enclosure. Fish which have been brought on to the long lead, follow it and soon become attracted by the light. They enter the first enclosure and are soon attracted into the last enclosure where they are caught by means of a lift net worked by a windlass. It is built in from 3 to 5 fathoms of water. The catch consists of a large variety of fish including Clupeoids, Carangids, Mackerels, Ambassis and other Percomorphs.

Blat.

The *blat* is smaller than the *kelong* and is built in shallow water up to a depth of 3 fathoms. It looks rather similar to the *kelong* except that there are three enclosures in addition to the long lead and it may not use a light. The screens are of fine mesh (diameter of holes = 1") and are made of rattan or galvanized wire netting. The fish are scooped out at low tide. The catch consists mainly of inshore fishes.

Jermal.

The *jermal* consists of two parallel rows of stakes. Each row is about 9 fathoms long and they are 3 to 4 fathoms apart. There are two long leads. Fish coming into the area between the leads are washed into the net which is set at a slant between the two parallel rows of stakes. The catch consists mainly of small clupeoids and shrimps.

Ambai.

The *ambai* works on the same principle as the *jermal* excepting that the parallel rows of stakes are replaced by a bag net of about

20 feet. in length. The fish are washed into the bag. The catch is similar to that of the jermal.

Blat Pok.

The *Blat Pok* consists of only one enclosure and a long lead. The enclosure is almost heart-shaped. The fish are brought by means of the lead into the enclosure where a net somewhat like a purse seine is used. The net is set immediately before the haul is made. Pomfrets and other valuable food fish are caught in appreciable quantities with this trap.

D. Miscellaneous.

Spears and barpoons.

Four kinds of fish spear or harpoon are known in Malaya, viz:—

- (1) An unbarbed spear known as *Tirok*.
- (2) A light barbed spear known as *Tempuling*.
- (3) A trident known as *Serampang*, and
- (4) A spear with a detachable barbed head and a long line attached to it known as *Julir* or *Tempuling*.

Dynamite.

The use of dynamite for fishing in Malaya and Singapore is illegal.

Poison.

The common poisons used for fish capture in this country are extracts of tuba root and Chinese tea seed cake. Their use is illegal except where it is desired to clear ponds of predators. For this purpose users are covered by special permits from the Department of Fisheries, Federation of Malaya and Singapore.

B. Cultural operations.

B(1) Fresh Water.

Freshwater ponds are very common in Malaya. It is the common practice among vegetable gardeners to rear a few pigs and some poultry as well as to keep a pond. Chinese carp are very popular, and four species viz:—*Ctenopharyngodon ideallus*, *Aristictbys nobilis*, *Hypophthalmichthys molitrix* and *Cyprinus carpio* are used. The ponds vary in size and shape. With the exception of *Cyprinus carpio* the other species do not breed in Malaya and the fry have to be imported from China. Every year on arrival, the fry (1"—2" in length) are readily bought up and with intensive feeding they are very rapidly fattened and are ready for marketing in less than a year.

Trichogaster pectoralis, known as *Sepat Siam* locally, are found in all the paddy fields in Malaya. They feed on the algae which are so abundant in the paddy fields and artificial feeding is not necessary.

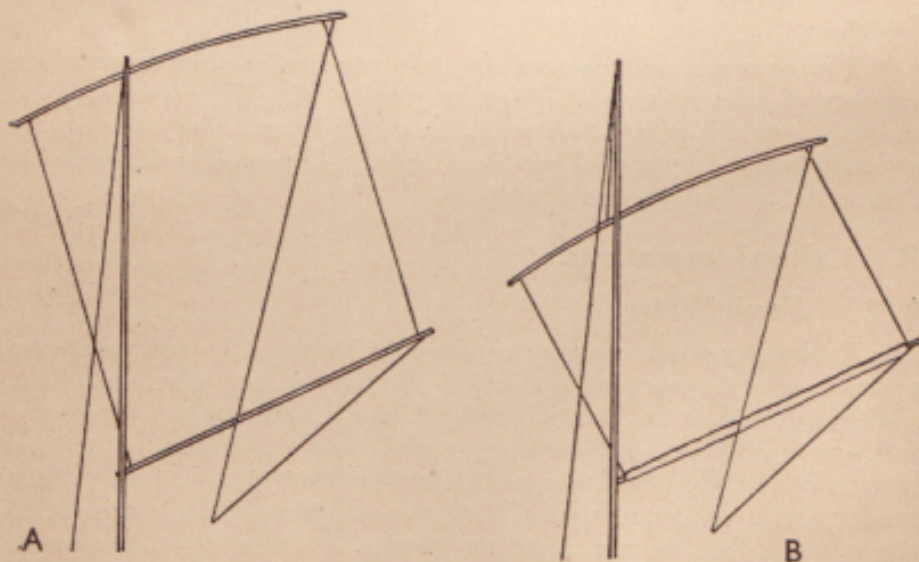
When the paddy fields are drained the fish are collected and sold. A small breeding stock is left in a sump pit until the fields are flooded again.

B(2) Brackish water.

In the mangrove swamps in the south west of Singapore, ponds are formed by the construction of bunds. They vary in size and shape and are provided with sluice gates to each of which a bag net is fixed. No artificial feeding is necessary and during the night at low tide the sluice gate is opened and all fish, shrimps and prawns rushing out will be caught in the sieve-like bag. The water level in the pond is maintained by admitting water at high tide. The crabs captured by *bintobs* also add to the income of the owners.

THE FISHING BOATS USED ON THE COASTS OF MALAYA by C. A. Gibson-Hill.

The great majority of the Malayan fishing boats rely for their propulsion on sail, augmented or replaced when necessary by oars or paddles. The present paper is concerned only with the boats in this category. The power-driven craft, neglected in this paper, include Chinese-owned fishing boats operated from Singapore and Pangkor Island (off the coast of Lower Perak). In addition there are launches (Plate 5, 2) based on Singapore, and a few on Endau (on the Pahang-Johore boundary), used to bring the catch from kelongs. Finally there are several motor-boats at Kuala Kedah and Kuala



A semi-diagrammatic drawing showing the standard sail set on the Malayan fishing boats, viewed from the stern, (A) running full, and (B) part-reefed. On the smaller boats the sail is usually approximately square, that is roughly the same distance from luff to leech as from head to foot. On the east coast the larger boats set tall sails (as shown on plate 13, 2), with the spread from head to foot appreciably greater than that from luff to leech. The only large Malay boat on the west coast, the Kedah Coast Koleh, reverses the principle, and sets a single large sail much broader than it is tall.

Perlis, employed mostly in taking the local sailing boats to and from the fishing grounds.

The local sailing boats range in size from a length of about 12 to 45 feet. There is considerable variation in the finish of the boats, and sixteen different kinds are summarised in the sections following this introduction, though in broad outline many of them are similar.

Certain general principles can be said to apply to at least the majority of these boats. They are all operated from, and in many cases in, shallow water. Frequently they have to be beached between each fishing trip. As a result they are all of shallow draught, and without keels of any appreciable depth. In association with this the almost universal sail is a standing lug. In all cases except one it is rectangular in shape, and as a general rule there is a boom as well as a gaff; the sail is then reefed by lowering the head and rolling it from the foot upwards round the boom. A few show minor differences in the kant or shaping of the stem and stern. Apart from this, and with the exception of the Sampan which has been introduced from China, the hulls are all double-ended. The great majority of the boats are normally steered with a paddle held over the lee quarter, though a few, noted below, have a rudder, with lines or a tiller. None of the boats are decked, though floor boards are fitted in all except the smallest, to separate off the bilge and provide a level dry base on which the fishermen can squat down on their haunches. The space beneath them, which is divided into compartments by the ribs, is generally used for stowing away the catch.

The most suitable approach to the local fishing boats is to consider them in two regional groups, those used on the east coast of Malaya north of the Sedili River (Johore), and those used largely or solely from the Sedili River round the south coast and up the west coast to the Perlis-Siam frontier. The data illustrating the basis for this distinction will be found in Dr. Dobby's paper (p. 25, *supra*). These relate primarily to differences of the coastal physiography and the nature of the fishing grounds, and to differences in the constitution of the fishing populations.

The East Coast Boats (Plates 11-15)

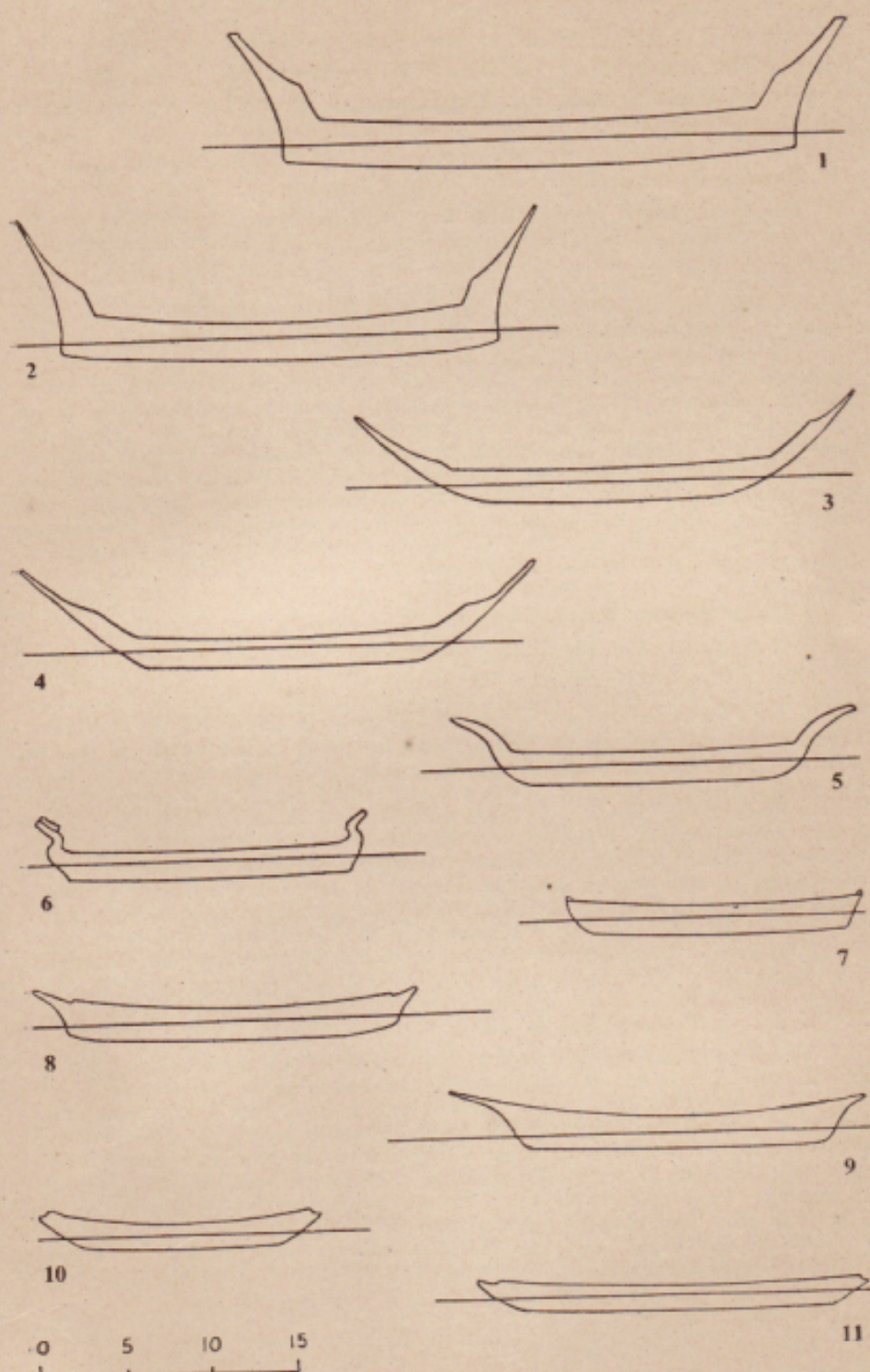
For the most part the east coast north of the Sedili River consists of long, sandy beaches, broken at intervals by estuaries, where mangroves occur. It is an exposed coast and bad weather may be encountered even in the calm season. In many places the best fishing areas lie ten or more miles from the land. Finally this area is even yet relatively isolated. It is populated chiefly by Malays, and except for the presence of Chinese-owned *kelongs* north to the Duchong Islands (between Endau and Pontian, in southern Pahang), the taking of fish is entirely in their hands.

The east coast boats are, of necessity, rather more robust than the majority of those used elsewhere in Malaya. They have to weather stronger seas more frequently, and the surf exposed beaches impose a considerable strain on them during launching and beaching. In addition the Malays do not like being away from their homes for more than a portion of a night at a time. As a general rule they try to get to their fishing grounds with the pre-dawn wind from the land, and return with the afternoon wind from the sea. To accomplish this they often carry more canvas, and run at faster speeds, than are attempted on the west coast. Finally there is a considerable amount of netting in open water, for which most areas have large boats, with smaller boats intended primarily for hand-line fishing.

There are further considerations affecting their finish. The east coast boats are built by Malays to be used by Malays and exhibit their general preferences in decoration and design; the Sampan, being of Chinese origin, is virtually unknown. Because of the importance of the boat to their livelihood, and the fact that it is their one considerable material possession, the fishermen traditionally are very sensitive to the details of their finish. Local preferences and fashions have grown up, and one finds boats with approximately the same hull lines appearing markedly distinct in different areas. This point comes out even further in the case of the names for the various designs; one design may be known by different names in different districts, and for conciseness, the present writer has selected what would seem to be the best known names from several in current use.

Broadly speaking it can be said that a narrow hull is faster but less steady than a beamy one, and that a boat with a long, angled keel keeps more easily to her course, while one with a short, rounded keel and good sheer rides better. Further the longer keel is in general more troublesome when getting the boat on and off an exposed beach if any appreciable sea is running. No design, of course, is perfect, but a beamy boat is better for use with sea nets, unless great distances must be covered in the day, while a narrow one is more suitable for hand-lining, where more time is required on the fishing grounds. Further a hand-line boat should be fairly small. The east coast fisherman does not like going to sea alone, in case he meets bad weather, but the catch per head drops sharply as the number in the boat rises above two.

On the east coast the boats used most generally with nets in deeper water, the Pěrahu Payang, the Pěrahu Buatan Barat and the Kolek Lichang, are all moderately beamy. The first two of these are long-keeled; the last has a short, rounded keel. The three most popular boats on the coast, the Gělibat, the Kueh and the Sěkotchi, are very similar in broad outline, though the Sěkotchi is appreciably less expensive as a result of its plain finish. All three designs are built as fairly large boats for net work, for which they are a shade too narrow, though they are faster than the Lichang on the out and



Feet

Line profiles of the eleven major patterns of fishing boats hulls built by the Malays on the east coast of the Federation of Malaya. The numbers correspond to those given in the short summaries in the text (p. 62 *et seq.*). In each case the bow is towards the left on the page, and the horizontal line represents the water level with the gear and normal complement of men on board.

in runs. The smaller editions are good, straight-forward hand-line boats. The outstanding hand-liner is probably the Jalorar, narrow, cranky, with a long keel, but the fastest of all the boats to and from the fishing grounds.

1. Perahu Payang (Plate 11, 1).

This is the largest of the Malay boats, ranging from a length of 33-35 ft., beam 6 feet, to 44-45 feet, with a beam over 7 ft. It is beamy, with fairly full buttocks, little sheer, and almost straight keel and steep, uprising ends. Unlike the other boats here it normally carries carved spar rests at both ends. It is a deep sea boat, used largely with the Pukat Payang at some distance from the shore. Paddles are employed while working the net, and the boat accordingly normally carries a crew of 15-20 men when fishing. It is moderately fast, but its disadvantage is its size and weight. This, with the low freeboard when fully laden, make it difficult to get it on and off an open beach if any appreciable sea is lively. On the other hand it is a much better sea boat, and is well adapted for running. It is therefore operated mostly from the estuaries at Kuala Trengganu, Kuala Kemaman, and Kampong Tanjong Lumpur (Kuantan). There are also a few working at Beserah, several kualas on the southern part of the Pahang coast and Mersing. During the season of the north-east monsoon some of these boats come down to Singapore, and they may even make their way up the west coast as far as Pangkor Island, off the Dindings, Perak.

2. Perahu Buatan Barat (Plate 13, 2).

The design of this boat is said to have come into Malaya from Patani, in Peninsular, Siam (*Buatan Barat* = made in the west). It is very similar to the Perahu Payang, but relatively lighter, and seldom exceeding a length of 32-34 feet, with a beam of about 6 feet. It carries slightly more sheer, and the ends taper almost to point. Typically it has only one spar rest, in the bows. It is used mostly with the lift net (Pukat Tangkul) or a mackerel drift net (Pukat Dalam), and generally carries a crew of about 5-7 men. Occasionally it is employed with 3 or 4 men for line fishing. It is the common boat along the coast from Kuala Besut northwards, but is seldom seen further south. It is interesting to note that over much of its range it is being operated from open, unsheltered beaches, for which it is not very suitable. At Tumpat, in the extreme north of Kelantan, much smaller boats, down to 18 feet in length, are occasionally built to this pattern for line fishing only. During the monsoon season short, stumpy ends are often fitted, for ease in handling, and in some old boats these are kept on throughout the year.

3. Kolek or Perahu Kolek. (Plate 11, 2).

This is an attractive, rather beamy boat with fine, up-curved ends and a well-rounded stem. It is not so fast as the Perahu Buatan Barat, and is rather more lively. On the other hand it is a much better sea boat, and is well adapted for hauling on and off open beaches. The Kolek Lichang is generally built to a length of 30-35 feet, with a beam of about 6 feet. It usually carries a crew of 5-10 men, and is employed with all the larger nets except the big Pukat Payang. It occurs in small numbers all along the east coast, but is most popular on the Trengganu coast from Kuala Kemaman north to Kuala Trengganu, where the best examples are said to be built. In this area, and on north to Besut, it is used extensively with a shore seine.

4. Kolek Pengayer

This boat is very similar to the Kolek Lichang, but it has a longer keel, with an angled fore-foot. It also has a steeper kant to the ends, and carries more sheer. It steers better, but it is not a good boat for open beaches. It is not very popular at the present time, and though odd examples are found from Beserah north to Kuala Trengganu, it is now numerous only on the Kemaman River, where there are 30-40, mostly at Kampong Kuala Kemaman. This boat would seem to have been much more popular formerly, and there are a number of old references to it under the name of Kolek Sa'hari Bulan (New-Moon Boat).

5. Kolek Kueh

This is the most variable of the east coast boats in both size and finish. Typically it is rather less beamy than the previous kinds, with a fairly long keel, rounded feet, and moderately long, foreward curving ends. The relative length of the latter is not constant, and in northern Trengganu and Kelantan they are sometime very short and squat. The smaller Kolek Kueh, which are used only for line fishing, are generally about 17-20 feet long and 3 ft. 4 inches beam. The larger boats are about 26-28 feet long, with a beam of just over 5 feet. These are used for line-fishing, and with all except the largest nets. The Kolek Kueh occurs in small numbers on the Pahang coast from Rompin to the Kuantan River; from here to the Kelantan River it is extremely popular, and on parts of the Trengganu coast there are large fleets of these boats, running to 30 feet in length, and used equally with the Kolek Lichang.

6. Kolek Gelibat (Plate 14, 1)

This boat has a very characteristic finish. The keel is long, almost straight, and sharply angled. The stem and stern are kanted steeply, rounded above the water line, and then carried foreward for a short distance. Typically the projection at the bow is ornamented with a carved plaque, like a comb. These boats are steered with a rudder, usually with line like a skiff. The Gelibat is the most popular of the older boats on the Johore and Pahang coasts except for the area of the Pahang River. Occasional examples are seen further north, but it is definitely scarce north of Kuala Kemaman. The Kolek Gelibat varies considerably in size, like the Kueh, whose place it takes in the south. The smaller boats are used by 2 or 3 men for line-fishing. The larger examples, up to about 26 feet in length and 4½ feet beam, are used both for line-fishing and with the smaller nets, including the shore seine.

7. Sekotchi (Plate 14, 2).

This is a plain boat, with hull lines rather similar to the Kueh and the Gelibat, but no decoration on the stem or stern. The size usually ranges from a length of about 16 feet, beam 3 ft. 4 inches, to 28 feet, with the beam 5 feet. The ends are kanted, the stem slightly rounded and the stern straight. The boat is steered with a rudder, either with lines or with a tiller. The smaller boats are used for line-fishing, with crews of 2-3 men; the larger ones, carrying up to 8-10 men, with the smaller nets or, with reduced crews, for line fishing. In view of its lower construction cost it has become extremely popular since the recent war, and it is now found widely all along the east coast.

8. Jalorar (Plate 12, 1).

This is a fine, fast boat with a long, straight keel, and kanted, projecting ends. The bow is well flared, and the hull reaches its maximum beam just foreward of the midpoint. It ranges to a length of about 28 feet, with a beam of 4 feet; this is appreciably less than that of the other east coast boats of equal length. The Jalorar is used almost entirely for line fishing, at some distance off the shore, and in good weather it is easily the fastest of the local boats. It usually carries a crew of 3 or 4 men, 1 or 2 of whom swing out on ropes attached to the mast as live ballast to balance the sail in a strong wind. Under favourable conditions it exceeds 8 knots. The Jalorar occurs mostly on the northern point of the Pahang coast, from Nenasik to the Kuantan River, with its greatest concentration on the Pahang River, where it is the most popular boat. There are also a few examples at Kuala Kemaman, and on Tioman, in the Pahang Archipelago. It would seem that it is difficult to operate from open beaches; certainly it is used almost entirely from river estuaries.

9. Bedar (Plate 12, 2).

The Bedar hull, with a long straight keel, and kanting stem and stern terminating in projections rather like the bill of a duck, has a wide variety of uses. It is the pattern of the commonest of the east coast sea-going carrying vessels, and is used, in miniature (the Anak Bedar), as a ferry boat in the estuaries from northern Pahang to southern Kelantan. It is not typically a fishing boat, but in parts of Trengganu and Kelantan the smaller boats are employed, with

2 men, for line-fishing, and in some localities, as at Kuala Trengganu, boats up to 28-30 in length are used with nets. These latter are, however, restricted to operating from kualas, and their almost flat projecting ends make them troublesome in a bad sea. The smaller examples are normally steered with a paddle, but the larger boats generally have a rudder and tiller like the cargo-carrying Bedar.

10. Dogol

11. Kolek Ma' Siam or Jo'kong¹

These are both Siamese boats, occurring in our area in small numbers from the estuary of the Kelantan River northwards. In this locality they are used, as fishing boats, mostly for hand lining with crews of 2 or 3 men; to some extent they take the place of the Gĕlibat. The Dogol is the better sea boat of the two, with considerably more sheer. Both are cranky, and probably moderately fast, but I have only seen them in very light airs.

The South & West Coast Boats (Plates 4, 9, 15 & 16)

The south and west coasts of Malaya are less exposed than the east side north of the Johore-Pahang Archipelago. There are extensive stretches of mangrove, and few long, sandy beaches. A greater proportion of the fishing is done close inshore, principally with hand-lines, cast nets or small nets. Finally there are Chinese communities on the coast, and much of the fishing in this area is in their hands.

The Sampan is used widely, and is the most popular boat except in Kedah (north of Kuala Merbok) and Perlis, and possibly in the Straits of Singapore and Johore. For the most part the Malay boats have no very distinctive characteristics, and only four kinds merit description here, the Johore Kolek, the Malacca Kolek, the Selangor Coast Kolek and the fine long kolek occurring from Southern Perak northwards. These are generally stained or painted black or dark brown, in contrast to the east coast boats, the majority of which are coloured white above the water line, and red or green below it. The first three are small or fairly small, lightly built, and very similar to each other. Solitary fishing is less dangerous here than on the east coast, and these three boats are built in different lengths covering the requirements of 1-3 or 4 men. The last on the list, the Kedah Kolek, is a much finer boat; it resembles some of the larger kinds on the east coast, except for its plainer finish, the absence of a crutch to hold the spars when anchored, and its use of a single, very broad standing lug in place of the two which are customary there in a boat of the same dimensions. The Kedah Kolek and the large Sampans, such as are seen at Malacca town, are the only big, deep-water boats on this coast.

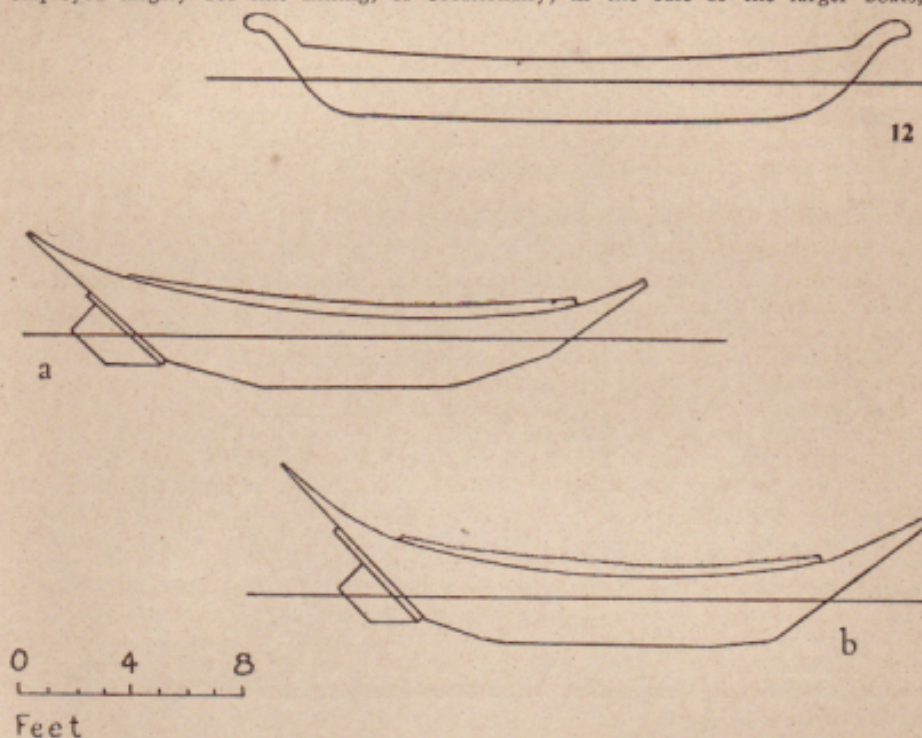
In addition to the Sampan and the various Kolek, which normally exceed at least 12 feet in length, two small dinghies are used in the estuaries and along the mangrove belt. One, the Pomehai, is a beamy, flat-bottomed boat with a square stern; it has almost the proportions of a Sampan, without the wings, and is built to a length

¹ Jokong (from Jongkong) is also applied to the small dinghy of the Pĕrahu Payang or Buatan Barat, used by the Juru Sĕlam when diving to listen for the shoals of fish.

of about 8-10 feet. The other, Sampan Kwak Tow, is equal-ended, square-cut at both bow and stern, and broadening in an equal curve to the mid-point of the sides (Plate 15, 2). Both would seem to be of Chinese origin.

12. Johore Kolek

This is a plan, simple boat, with a straight keel. It is fairly similar in its general lines to the smaller east coast boats, but it is usually less full in the bilge and it tapers more gradually. The ends are kanted and curved outward for a short distance at the top, giving in profile the effect of a snub-nose, not unlike a miniature edition of the Kuch Buteh Kétiri. It is usually sailed with an ordinary Malay standing lug, which is occasionally loose-footed, but some owners set a triangular fore and aft sail, with or without a jib. With the latter rig it is moderately fast, and can be sailed fairly close to the wind. For short distances these boats are frequently propelled by oars, in the manner of the Sampan, the man standing facing the bows and leaning forward to drive the kolek along. They are usually steered with a paddle, but some of the sloop-rigged boats have rudders with lines. The Johore Kolek mostly ranges between 15 and 25 feet in length, with a beam of $2\frac{1}{2}$ to $3\frac{1}{2}$ feet, and carries 1-3 men. It is cranky, and is employed largely for line fishing, or occasionally, in the case of the larger boats,



Line profiles of the hulls of the Johore Kolek (No. 12, as in the text) and the Chinese fishing Sampan (No. 16 in the text), as usually built in the Straits of Singapore (a), and on the west coast of Malaya in general (b). In each case the bow is towards the right of the page, and the horizontal line represents the approximate water level with the gear and one man on board.

with a shore seine. It is found mostly from the Johore Islands and the Sedili River, round through the Straits to the west coast of Johore.

In Singapore the Chinese carpenters build a rather similar boat which they call Kolek or Kolek Selat (Straits Kolek). In general it is rather simpler in shape and workmanship (Plate 15, 2); the cross-section amidships may be almost V-shaped, and the ends, which terminate just above the gunnel, are usually more nearly plumb. It is sailed with a square-headed standing lug, and steered with a

paddle, but a number of these boats are propelled only by oars, and do not carry a mast. The Straits Kolek is much used by the kelong fishermen, as a ferry boat, and its distribution roughly corresponds to that of the kelong.

13. Malacca Kolek (Plate 15, 1).

This is a plain, rather crudely built kolek, with a straight keel, and a well-raked stem and stern. It ranges in size from a length of about 12 feet, beam 3 feet, for 1 man, to a length of about 21 feet, beam $3\frac{1}{4}$ feet, for 3 men. It is normally steered with a rudder and lines. The distinguishing features are a small cross block above the bows for the rope when anchored at the fishing grounds, and a peculiar wing-like decoration sticking up above the stern (see plate). It is used almost entirely for hand-line fishing. It is restricted to the coast of Malacca territory, and is most plentiful round Tanjong Kling, about 5 miles north of Malacca town. It is not used by the Chinese, who in this district build a bulky, heavy Sampan about 20-24 feet long.

14. Selangor Coast Kolek

This boat has rather fuller bilges than the Johore Kolek, appreciable sheer fore and aft, and well raked ends. The stem and stern rise only a few inches above the gunnel, and the terminal 2 feet or so of the boat are usually decked. The general proportions are about the same as those of the Malacca Kolek. The Selangor boat may be steered with a paddle or a rudder. It is generally sailed with a standing lug, but a number now set a triangular fore and aft sail, with or without a jib. It is used mostly for line fishing, or with a cast net. The full range of this boat is not known, owing to the difficulty of reaching parts of the Selangor coast, but it certainly occurs from the northern entrance of the Straits of Klang north to Kampong Sekinchang, beyond Kuala Selangor.

15. Kedah Cost Kolek (Plate 9, 2).

This is much larger than the preceding koleks, with rather finer lines. It has an almost straight keel, moderate sheer fore and aft, and well raked ends which usually curve inwards just above the level of the gunnel. It is a fast boat, and in the larger examples is frequently built with the maximum beam just forward of the midpoint. In this it resembles the Jalor of the Pahang River estuary, but it is not normally quite so narrow. It mostly ranges in size from a length of about 24 feet, beam 4 feet, to 30 feet, with a beam of 5 feet. It carries only one mast, setting an immense single standing lug. This sail differs from those used on the east coast of Malaya in being longer from luff to leach than it is from head to foot; frequently the boom is appreciably longer than the length of the boat along the water-line. This kolek also differs from the east coast boats in having no crutch for the mast and spars; except when it is beached the mast is usually left standing, with the reefed sail made fast to it. It is steered with a great, long-bladed paddle, much larger than those used for even the bigger *Pèrahu Payangs*. This boat is normally employed with a crew of 3-6 men working drift nets, seines or long-lines (*Rawai*). The smaller examples, with a reduced complement, are also used for hand-line fishing. It occurs along the coast from Pangkor northwards, reaching its greatest concentration in our area at Kuala Kedah and Kuala Perlis.

16. Sampan (Plate 16, 1 & 2).

This is the ordinary South China Sampan hull. Small boats, with an overall length of 18-25 feet, and a beam of 5-6 feet (Plate 16, 2) are used widely from Singapore Island round up the west coast to southern Kedah, and over much of this area are the most numerous of the fishing boats. They are normally sailed with a standing lug, which may be reinforced with bamboo battens. The Sampan is slow, but very steady, and it is employed for line fishing or with a cast net. It is used mostly by the Chinese, but in some areas it has been adopted by the Malays. Larger boats are built in a few areas, for working fishing grounds further from the coast, and with long lines (*Rawai*). There is a fine fleet of these vessels, 30-35 feet long and about 8 feet beam, operating from Malacca town; they carry two masts, both setting single battened lugs of the Chinese pattern, not the squareheaded sails usually seen in Malayan waters (Plate 16, 1).

VIII. ORGANIZATION AND ECONOMICS OF THE INDUSTRY.

In the preceding chapters of this Part we have given a brief account of the essential elements of this industry with some consideration of the surrounding environment, social and physical, within which the industry operates. In this chapter we describe the forces by which the industry is organized and held together as a system of some efficiency.

Ownership and Operation of Equipment: We may recognize various forms of ownership; the basic system of classification is to distinguish between those instances where the equipment is owned entirely by a single individual and those where ownership is shared among a number of people. In the latter case distinction must be made between those instances where the property rights of the individual consists of a share (measured in terms of money or as a physical proportion) of the equipment and those where his rights relate only to a part of the equipment which he has brought to the common pool, generally as a temporary arrangement. The second system of classification, which crosses with the first, is whether the owner is an operator or not. Where the owner is not the operator or user of the equipment there are various forms of arrangement in respect of its use; in some cases the arrangement amounts to a partnership, in other to a lease on very special terms and in others to direct employment.

As might be expected, the simpler (cheaper) types of gear, such as the simple traps (*bubu* etc.), lines, cast and thrust nets, are generally the property of the owner-operators. In the Malay community studied by Firth (l.c.) there were 206 boats for 550 fishermen, 33 per cent of whom owned the vessels which they operated; roughly 12 per cent of the 206 craft were owned by persons other than those who operated—some of the owners were non-sea-going people, some were lift-net experts and some were other fishermen. In the relatively highly capitalized fishery employing the purse-seine, and in the kelong fishery of Singapore and Johore, the situation is chiefly one of employment: the entire equipment is owned by non-sea-going personnel who employ the operatives on special terms (see below). The arrangements in the net fisheries (of which the community studied by Firth is an example) are more complicated, for while the ownership of craft may be vested in a single individual, the net used might be the property of many; this is particularly the case for the gill-nets of which sections can be joined together, and is an instance of multiple ownership on a kind of partnership basis. Various forms of partnership, from equal sharing of all costs and risks to an arrangement in which the share of one of the partners is simply the labour he provides, may be observed. Of the leasing arrangements many forms are observable, the common type being that in which a share of the earnings is assigned to the owner of the boat and/or equipment.

On the question of acquisition of capital equipment Firth (l.c.) discusses for his Malay community six types, as follows.

- i. Full purchase, with unitary ownership;
- ii. Putting up capital for manufacture;
- iii. Purchase on time payment;
- iv. Purchase on borrowed capital;
- v. Acquisition in partnership;
- vi. Borrowing of equipment without transfer of ownership.

It will be recognized that the methods afford opportunities for the activities of money lenders.

Capitalization: Gopinath (MS) states that the capital of a small company engaged in purse-seine fishing and the processing of the catch would be in the order of \$70,000 (1947 values) of which roughly half would be for sea-going equipment and half for the shore establishment. Tham and Le Mare (1947) give the cost of construction of a *kelong* at \$15,500 in July 1946; the operating costs at that time were in the order of \$750 per month for a large *kelong*; these figures however relate to a particularly abnormal period: the construction cost was slightly more than five times the cost in 1939. In his work, referred to above, Firth gives the value of different items of gear (Tables 1 and 9) and of boats (Table 8) in 1940; the boats ranged in value from \$30 to \$450, and the gear ranged to a value of \$550 per unit in the case of the *pukat terek*; at that time Firth estimated the average capital per fisherman in Kelantan and Trengganu at about \$40. At the present time (1949) a 20-foot Sekotchi would cost in the order of \$150—\$170, and one of 26-27 feet would cost \$250—\$260; other boats would cost substantially more.

Finance, both for capital acquisition and for operating costs, is obtained in customary methods, by saving and various types of borrowing. The family provision of finance is important among both Malays and Chinese but the bulk of finance is in the hands of local towkays who directly or indirectly draw their finance from import-export firms in Singapore dealing in salt-fish.

Firth (1.c.) describes the arrangement under which seasonal advance of friendly loans and so forth are made in a Malay community; an interesting feature of this is the custom of holding large feasts at which gifts or loans of cash or kind are made to the giver of the feast. In general it is true that availability of finance is as important here as in the fishing industries of other countries and that the dealer, as money-lender, exercises a considerable influence on the industry.

Distribution of Earnings: In the matter of distribution of earnings we may refer to three distinct types of operations which are well documented. These are the share distribution of the 'co-operative' operations of Kelantan-Trengganu, described by Firth (1.c.); the wage system in the operation of the *kelong*, as described by Tham and Le Mare (1947); the share system of the *kembong* industry of the west coast (Le Mare 1947).

In the share system described by Firth there is allotment of portions of earnings, according to contributions of capital, equipment and labour with bonuses for skill, leadership and extra work. For the lift-net outfits he gives the following kind of allotment:—

<i>Unjang</i>	10%
Net	15%
Boats	11¼%
<i>Juru Selam</i>	1½%
Crew	62¼%

These percentages are arrived at not directly, but by an elaborate series of steps. Capital commands from 1/3 to 3/7 of the earnings and labour and skill the remainder. Each fisherman receives about 2% of earnings. In the case of the *pukat dalam* the following rules are reported: ½ the earnings to the net and the remainder is divided thus—the boat two shares, and ordinary crew man one share, with additional shares, one each to the men paying out and handling the net at sea, one to the man who bales, one to the captain of the boat, one to the *juru selam*, when employed. In general the shares to net and boat are expected to cover cost of maintenance as well as provide a return on capital.

In these states (Kelantan and Trengganu) at that time (1939) the average income was in the order \$110 p.a., but that there was considerable range about this figure, with 50% receiving less than \$104 p.a., 5% receiving between \$260 and \$520 p.a. and one man with income between \$1040 and \$1560 p.a.

The operation of the *kelong* is managed on a direct employment basis. Each *kelong* is managed by a team of people consisting of a headman and 2 to 4 assistants; the wages of these people were, in 1946, \$100 p.a. for headman and \$65 to \$80 p.m. for assistants. In addition, the members of this team are fed by the *kelong* owner at a cost (1946) of \$45 per head p.m.

The *kembong* industry employment arrangements represent a combination of wage and share systems, and are somewhat complicated. The shore personnel (in the factory, in net-repairing and in management) receive straight-out wages from the company. The personnel on the powered vessel also receive straight out wages. This group also generally receives food. The sea-going personnel receives the bulk of its income as a share of the value of the catch which is sold to the company at a fixed rate. The total return is divided as follows:—

1 Fishing Leader (hang kong)	1½ shares
2 Fish watchers at 1½ shares each	3 „
2 Fishing helmsman at 1½ shares each	3 „
14 Fisherman at 1 share each	14 „
2 Cooks at ½ share each	1

The fishing leader receives a bonus of 5% of the gross proceeds of the sale but it is not clear whether this is deducted from the gross earnings before the above division is made, or whether it is an additional charge met by the Company. New fishermen receive only half shares. The fishermen receive meals in addition to the above; this is chiefly rice, oil and fish. The Company makes money advances to the fishermen before the season and recovers this outlay from the shares allotted. Under this arrangement the Company has a heavy basic commitment of wages, food-bill and operating costs. The fishermen engaged are ensured at least food for themselves and receive a money income in accordance with the success of their fishing. At a price \$5 per picul paid to the fisherman for the fish, and an average landing of 4,500 piculs per boat, the money income per fisherman (with one share in $22\frac{1}{2}$) would be about \$1,000.

Controlling Factors: We may recognize that the functioning of this industry is subject to the operation of a number of factors. These include—availability of fish; meteorological and other geographic conditions; the availability of raw material (nibong, ramie twine, cotton twine); the strength of the demand for fish; the general economic situation; the availability of manpower. Whilst no accurate measurement has been made of these factors some observations have been made on them. Availability of fish does not seem as yet to constitute a limiting factor of the industry; there undoubtedly are seasonal fluctuations and changes in abundance from year to year, but these appear not to be limiting, as yet. The monsoons exercise a definite influence on operations and at certain times of the year lead to cessation of operation. Firth's table 5 (l.c.) makes an analysis of the effect of weather among other things in restraining fishing operations. The short supply of raw material immediately after the war had a severally restrictive effect on the industry but these difficulties have generally been overcome. Judging from the price offered in Singapore and elsewhere it would appear that the demand for fish is very strong, and the general prosperity of the country must be conducive to effective development of this industry. At the present time it would seem that this industry is in a very favourable condition to make substantial technical and economic progress.

IX. MARKETING AND DISTRIBUTION OF FISH AND FISH PRODUCTS.

The fish trade of Malaya-Singapore is subject to the considerable influence of the city markets of Singapore and Kuala Lumpur and of Singapore's entrepot trade.

Before the war the total landings in Malaya and Singapore were in the order of 84,000 metric tons, probably of round wet weight. To this total was added a quantity equal to about 12,000 metric tons landed from the Rhio Islands and by the Japanese, which in effect were importations. It was estimated that about $\frac{1}{3}$ of the local landings were processed, which means that about 68,000 metric tons of fresh

FISH LANDINGS MALAYAN UNION AND SINGAPORE 1947
(Weight given in Katies and Tons)

STATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
Kedah	275656	217677	495013	500726	506962	290462	402197	410211	447576	359966	1394702	1039800	6340948
Perlis	71200	88045	107489	294838	158211	116095	183314	114859	121820	175803	328775	192880	1953329
Penang	1000106	616278	599280	439888	643990	628824	679463½	491777½	518916	706704	1047903	716524	8094654
Perak	1573322	2162922	1738201	2666713	1919427½	1251354	1535528	1527706	1253539	2439440	2577358	2508267	23153777½
Selangor	523936	727700	810500	520600	415081	450000	462858	408730	466760	418310	307630	333858	5845963
Negeri Sembilan	7154	7507	6325	8039	9127½	27243	63870	60690	52567	21912	25125	24312	313871½
Malacca	325398	225221½	239761½	256153	288615	285427½	310100½	332963	330768½	313536½	355977	464603	3728525
Johore	448247	403143	460563	989960	2052143	647565	513938	612083	605631	575310	586430	452973	8347986
Kelantan	88890	272590	191520	338140	372354	383055	426772	524825	383574	376708	76994	29280	3461702
Trengganu	109400	404300	240800	291203	780600	490000	451800	776700	967400	444500	361900	56600	5375200
Pahang	83185	184993	279950	705827	469657	313726	403430½	277839	268994	403695	163094	71332	3624722½
TOTAL — M.U.	4506494	5310376½	5169402½	7009084	7620168	4883751½	5433271½	5538383½	5417545½	6235884½	7225888	5890429	70240678½
SINGAPORE	1371396½	1204653½	1296733	1422200½	1320469½	1162928½	1248238	1348186½	1399138	1390475½	1328417	1462400½	15945237
TOTAL KATIES	5877890½	6515030	6466135½	8431284½	8940637½	6046680	6681509½	6886570	6816683½	7616360	8554305	7352829½	86185915½
TONS	3,498.7	3,878.0	3,848.9	5,018.6	5,321.8	3,599.2	3,977.1	4,099.2	4,057.5	4,533.5	5,091.8	4,376.7	51,301.0

Average per month for:

Malayan Union & Singapore

Do. Malayan Union

Do. Singapore

Katies

Tons

7,182,159

4,275

5,853,389

3,484.1

1,328,770

790.9

TABLE II.

fish were available to the population of Malaya-Singapore. The 1/3 converted to the processed fish may be reckoned at about 14,000 metric tons of locally produced processed fish (salted fish, blachan and fish-fertilisers). To this was added some 50,000 tons of salt-fish, 700 tons of blachan and 6,000 tons of fish-fertiliser, a total of 56,700 tons of fish products imported; making a total of 70,700 tons of fish products. There was however substantial export amounting to about 59,000 tons. That is some 12,000 tons were retained in Malaya-Singapore.

Since the war the local production of fresh fish has been steadily recovering (in 1947 it was estimated at about 42,000 tons), but the entrepot trade is still sluggish.

The primary transaction takes place generally on the beach or on the water itself. In Firth's book, referred to in earlier chapters, an account is given of the bargaining practices in the first sale in the States of Kelantan and Trengganu. Similar practices are in use generally in the area except of course, in this important fishing for the *kembong* where, as indicated in the previous chapter, the fishermen are paid at a fixed rate by the Company whose boat and gear they use.

There are, as indicated by Firth and as is usual in this industry, various types of dealers. On the peninsula each village has 1, 3 or 5 agents (or dealers) to whom the fishermen are tied by debt. These agents buy from the fishermen. On the east coast the catch is despatched by lorry to nearby towns or in bulk by Straits Steamer to a principal agent in Singapore. From the west coast the fish is despatched on similar routes, but also to Penang, Klang, Port Swettenham, etc. At each village there are always in addition some buyers who may be middlemen, or hawkers, or lessees of slabs in a nearby market.

The Singapore fresh fish markets operate primarily in local landings to which are added substantial supplies from the Rhio Archipelago. Before the war, the non-local supplies formed the bulk of the Singapore supply; in 1937 the local supply was only 10.7% of a total of about 14,000 metric tons, whilst Japanese landings were 59.3% and landings from Rhio were 29.1%. These supplies are drawn to Singapore partly by the fishermen themselves, partly by the activities of the agents located along the coast and partly by carrier vessel. The latter are at times despatched on special expeditions, either to collect a pre-arranged freight or to seek out and bargain for freight. The markets at Singapore are the only ones where auctioning takes place. The fish brought in by fisherman, carrier or public transport is sold by an auctioneer representing a principal dealer; the fish is bought by retailers either of the type renting a slab in the market, or of the hawker type. A charge of 10% is made for such sale, and half of this charge is paid to the Municipality. There is not much processing of the supplies of fresh fish which reach Singapore, although there is a little cooking.

The principal processing techniques are cooking and drying and salting. There is no canning, a little manufacture of fish-sauce, a fair production of shrimp paste (*blachan*), and some manufacture of fertiliser and meals. The cooking and the drying and salting are carried out wherever fish are landed—but the largest centre is at Pangkor where the *kembong* is landed. This local production of processed fish is small beside the quantity entering the entrepot trade. The bulk of the pre-war imports came from Siam and Indo-China (about 45% each); Indonesia was the chief buyer of these supplies (about 93%).

The price of fish in Singapore is high, relative to its production factors and to prices of similar foods in other countries. The Fisheries Department groups the fish species into three price groups as follows:—

1st Quality: *Bawal*, *Belachan*, *Cbermin*, *Demudok*, *Jenabak*, *kachi*, *Kerapu*, *Ketam*, *Kurau*, *Merah*, *Parang*, *Sagai*, *Senangin*, *Tenggiri*, *Terubok*, *Udang*.

2nd Quality: *Belanak*, *Bilis*, *Delab*, *Duri*, *Chencharu*, *Gelama*, *Kembong*, *Selar*, *Selangat*, *Tamban*, Other kinds.

3rd Quality: Duck Food, *Pari*, *Yu*.

Representative current prices (per kati) in Singapore are as follows.

1st Quality: *Bawal* \$1.40, *Tenggiri* \$1.10, *Parang* \$1.00, *Udang* \$1.60, *Kurau* (split) \$1.70.

• 2nd Quality: *Tamban* 35 cts., *Bilis* 45 cts.

There is of course considerable variation in these prices and in the proportions of these qualities of which the catch is composed.

Appendix i.

Notes on the Fisheries of North Borneo and Sarawak.

NORTH BORNEO.¹

The fishing industry of the Colony of North Borneo is in an extremely primitive condition, with practically no mechanization of either boats or equipment. The industry depends almost wholly upon the inshore and estuarine stocks of commercial species, and except for two minor excursions does not extend more than four miles from the coast.

The only section of the industry which is any way organized is that operated by Chinese (Hakka and Cantonese) fishermen. These men use very small hand or wind driven vessels, few of which, if any, exceed 60 ft. in length. There are no cultural operations.

The native fishery is conducted by the coastal people of the Colony, the majority of whom are Dusuns, and by the itinerant Bajaus and Suluks who wander in from the islands of the Southern Philippines.

Statistics of manpower, equipment, etc. employed in this industry are not available.

Fishing Methods.

I. Marine

A. Boat Fisheries: Of the boat operated fisheries, using drift nets ("*pukats*" of various types), the most significant is the kurau fishery extending southward into the Straits of Macassar from Tawau on the East Coast. Along the Northern coast in the Sandakan-Tambesan region small meshed *pukats* are used in the shallow water off the large estuaries. These two fisheries are operated solely by Chinese. Along the West Coast there is a poorly developed troll line fishery for Spanish mackerel and tuna, operated by the Benadan people, inhabiting off-shore islands. Coastal natives in the Jesselton area carry on a small but somewhat specialized fishery employing the *unjang* and the fish are captured by means of a large scoop net called "*layal*". The boats used in this fishery are small gobungs rarely exceeding 20 ft. and generally propelled by paddles. In the river mouths, and to a slight extent in the more open coral channels the semi-floating types of long-line (*rawei* and *bilamas*) are worked from small canoes.

Some of the medium-sized Chinese-owned vessels up to 30 ft. in length are employed almost wholly for hand-line fishing and the

¹ Digested from Statement made at Buitenzorg Meeting (see page 25) by J. A. Tubb, Director Fisheries, N. Borneo, and from other official reports.

fish are brought into the markets alive in wells situated amidships in the vessel.

B. Trap fisheries: The coastwise small *kelongs* are owned and operated mainly by the coastal tribes. These traps are comparatively small and the catches are seldom large.

Within Brunei Bay and the Labuk Estuary, to the north, a characteristic type of prawn fishery has developed, using the conical *tugob* net, usually operated in pairs, and usually set in long rows extending across the flow of the tide. These lines consist of a series of up to 22 permanent frames from which the nets are suspended.

A recent development is the use of the *tugob* net in comparatively deep and open water. In this case only one net is used, a single frame is constructed and the entrance to the frame is provided with diverging rows of slender "Scarer" sticks, extending up to 200 yds. on either side. This latter method of use of the *tugob* is virtually restricted to Chinese operatives, whereas the river type is operated by Brunei natives and by the native peoples in the Labuk areas.

The large wicker trap or *bubu* which is used in the deeper coral channels and in the vicinity of isolated reefs is worked mainly by native people.

C. Miscellaneous: A variety of small beach hauling nets, the lift net (*salambau*), the push net and the cats net (*rambat*) are in general use operated from small canoes, or by wading in the beach shallows as the tide rises.

Several species of edible bi-valves and gastropods, trepang and seaweed are gathered by hand.

II. River fisheries.

The river fisheries are primitive in the extreme and depend on small wicker traps (*belat*), stone weirs and hand lines. A short line with baited hook suspended from a small float is in common use in eddies and areas where flow is not too rapid. Spears and derris root are widely used.

Marketing.

Fresh fish markets are found in larger centres along the coast in no instance is there machinery for regulating the daily supply of the Colony, but in few cases are they in any way organized, and refrigeration and cold storage are non-existent, and the fresh fish market depends on daily catches and deliveries. At Sandakan, Lahad Datu and Tawau, small motor-boats are used to pay daily visits to the *kelongs* to collect the fish and bring them to market.

The salt and dried fish trade is wholly in the hands of the Chinese who purchase the fish from the fishermen, process it and distribute it. The bulk of current production is exported. It is estimated

that 1948 export of salt fish was 1,400 tons, with 220 tons of dried prawns and prawn dust.

Organization of the Industry.

Practically the entire industry is financed by the Chinese under the "*towkay*" system, closely resembling the "*laan*" system which operated in Hongkong pre-war. The fisherman is provided with equipment, boats and gear, food and clothing and even cash advances by the Chinese *towkay*, and is thereafter under contract to supply the *towkay* with all fish caught. It frequently happens that the initial debt is so large that the fishermen never escapes and there is evidence to suggest that some debts have been carried on for up to three generations within the one family. The operation of this system is open to, and suffers from, considerable abuse, but nevertheless it has many aspects which render it relatively satisfactory in a backward and unprogressive community such as that found in the majority of the native coastal villages.

SARAWAK.¹

There are good fishing grounds by native standards in the immediate vicinity of Sarawak and many of the people on the coast depend on fishing for their livelihood; fish plays a large part in the national diet. Most of the fishing is carried out by measures centuries out-of-date, and the methods of drying, curing and marketing are archaic.

Fresh water fisheries on a small scale are maintained by Chinese small holders near the towns. Sea fisheries are mainly coastal and are worked usually by small syndicates. Most of the fishermen are Chinese, Melanaus or Malays. In their main features these fisheries resemble those of Malaya and North Borneo. Some of the same types of craft and gear are to be observed in operations engaged on the capture of the same groups of fish; similar organizational features are to be observed in the industry. A proportion of the catch is marketed and distributed fresh but about half of it is salted.

Methods of Fishing.

Apart from the small amount of fresh water fishing there are 3 divisions of the industry—on-shore, off-shore surface and on-shore bottom. The on-shore operations engage the attention of some 1700 men and, from the point of view of manpower engaged, these are the most important. The gear employed includes Seines (*pukat*) traps (*blat*) cast nets (*palar*) push nets (*sugkor*). The off-shore surface operations of the Malays employ gill nets (*rantau*) and encircling nets (*lengkong*) whereas the Chinese operations employ gill nets for the *Benong* and *trubok*. There are about 700 Malays and about 400 Chinese engaged in this section. The off-shore operations

¹ Prepared from notes supplied by Mr. E. Banks, Fisheries Survey Officer, Sarawak.

engaging the attention of about 750 men involve the use of fixed traps (*jermal*, *jonkat* and *kelong*), movable traps (*pengireb*, *pintoh* and *bubu*) and lines (*gorit*, *taut* and *rawei*).

Marketing.

It is estimated that some 55,000 piculs of fresh fish are caught in the year, of which perhaps one half is consumed as fresh fish, the remainder made into salt fish.

Appendix ii.

Glossary of Malayan Names of Fish and other Animal and of Fishing Gear and Boats.

FISH. *

Scientific Name.	Malay Name.
Scyliorhinidae	Yu Pendek
Hemiscyllium spp.	Yu Tokek
Eulamia spp.	Yu
Sphyrna spp.	Yu sanggol; Yu bengkong
Pristidae	Yu gergaji
Rhinobatidae	Yu kia-kia
Torpedinidae	Pari kebas
Dasyatidae	Pari
Mobulidae	Pari paus
Elops machnata (Forskael)	Bandang
Megalops cyprinoides (Broussonet)	Bulan-bulan
Scleropages formosus (Muller & Schlegel)	Kelasa
Chirocentrus dorab (Forskael)	Parang-parang
Motopoteridae	Belida
Dussumieriidae	Tamban bulat
Dorosomidae	Selangat
Hilsa spp.	Terubok
Clupea (Harengula) spp.	Tamban
Stolephorus spp.	Bilis
Muraenesocidae	Malong
Clarias spp.	Keli
Plotosidae	Sembilang
Rasborinae	Seluang
Belonidae	Todak
Hemirhamphidae	Julong-julong
Exocoetidae	Terbang or Ikan Belalang
Psettodidae	Sebelah
Soleidae	Lidah
Atherinidae	Rennyau
Mugilidae	Belanak
Sphyraenidae	Alu-alu
Polynemidae	Kurau, Senohong, Senangin
Hippocampus spp.	Kuda laut
Euthynnus spp.	Tongkol
Scomber spp.	Kembong
Scomberomorus spp.	Tenggiri
Trichiuridae	Selayur
Caranx (Selar) spp.	Selar
Caranx (Carangoides) spp.	Sagai
Megalaspis cordyla (Linnaeus)	Chencharu
Scomberoides spp.	Talang
Stromateidae	Bawal
Leiognathidae	Kekek
Anabas spp.	Puyu; Betok
Trichogaster spp.	Sepat
Ambassis spp.	Sia-sia

Scientific Name.	Malay Name.
<i>Amia</i> spp.	Seriding
<i>Serranus</i> spp.	Kerapu
<i>Lutianus</i> spp.	Merah
<i>Caesio</i> spp.	Delah
Theraponidae	Kerong-kerong
Lethrinidae	Asoh-asoh
Gerridae	Kapas-kapas
Mullidae	Biji nangka
Sciaenidae	Gelama
Sillaginidae	Bulus-bulus
Toxotidae	Sumpit-sumpit
Scatophagidae	Ketang
Monacanthidae	Barat-barat
Siganidae	Dengkis; Debam
Tetradontidae	Buntal
Antennariidae	Lepu
Malay Name.	Scientific Name.
Alu-alu	Sphyrnidae
Asoh-asoh	Lethrinidae
Bandang	<i>Elops machnata</i> (Forsk.)
Barat-barat	Monacanthidae
Bawal	Stromateidae
Belanak	Mugilidae
Belida	Notopteridae
Biji nangka	Mullidae
Bilis	<i>Stolephorus</i> spp.
Bulan-bulan	<i>Megalops cyprinoides</i> (Broussonet)
Bulus-bulus	Sillaginidae
Buntal	Tetradontidae
Chencharu	<i>Megalaspis cordyla</i> (Linnaeus)
Dengkis; Debam	Siganidae
Delah	<i>Caesio</i> spp.
Gelama	Sciaenidae
Julong-julong	Hemirhamphidae
Kapas-kapas	Gerridae
Kekek	Leiognathidae
Kelasa	<i>Scleropages formosus</i> (Muller & Schlegel)
Keli	<i>Clarias</i> spp.
Kembong	<i>Scomber</i> spp.
Kerapu	<i>Serranus</i> spp.
Kerong-kerong	Theraponidae
Ketang	Scatophagidae
Kuda laut	<i>Hippocampus</i> spp.
Kurau, Senohong, Senangin	Polynemidae
Lepu	Antennariidae
Lidah	Soleidae
Malong	Muraenesocidae
Merah	<i>Lutianus</i> spp.
Pari	Dasyatidae
Pari kebas	Torpedinidae
Pari paus	Mobulidae
Parang-parang	<i>Chirocentrus dorab</i> (Forsk.)
Puyu; Betok	<i>Anabas</i> spp.
Rennyau	Atherinidae
Sagai	<i>Caranx</i> (<i>Carangoides</i>) spp.
Sebelah	Psettodidae
Selangat	Dorosomidae
Selar	<i>Caranx</i> (<i>Selar</i>) spp.
Selayur	Trichiuridae
Seluang	Rasborinae
Sembilang	Plotosidae
Sepat	<i>Trichogaster</i> spp.

Malay Name.	Scientific Name.
Seriding	Amia spp.
Sia-sia	Ambassis spp.
Sumpit-sumpic	Toxotidae
Talang	Scomberoides spp.
Tamban	Clupea (Harengula) spp.
Tamban bulat	Dussumieriidae
Tenggiri	Scomberomorus spp.
Terbang	Exocoetidae
Terubok	Hilsa spp.
Todak	Belonidae
Tongkol	Euthynnus spp.
Yu	Eulamia spp.
Yu gergaji	Pristidae
Yu kia-kia	Rhinobatidae
Yu pendek	Scylliorhinidae
Yu sanggol; Yu bengkong	Sphyrna spp.
Yu tokek	Hemiscyllium spp.

Mollusca.

Scientific Name.	Malay Name.	Malay Name.	Scientific Name.
Lamellibranch:			
Anodon	kepah	Angkek	Conus
Arca	kerang	Beliong	Pinna
Asaphis	kepah kurap	Belitong	Cerithidea
Cardium	puting puteri	Belongkeng	Ellobium
Chama	togok	Chomek-chomek	Loligo
Circe	remis	Enam	Galeodes
Corbicula	remis	Gondang	Tonna
Cyrena	lokan	Hapsel	Harpa
Meretrix	kepah gading	Kapis	Pecten
Modiolus	kupang	Kepah	Anodon
Mytilus	kupang	Kepah gading	Meretrix
Ostrea	tiram, teritep	Kepah kurap	Asaphis
Pecten	kapis	Kerang	Arca
Pholas	sela batu	Ketem, song song	Murex
Pinna	beliong	Kilah, siput kachar	Voluta
Placuna	sinting	Kulai, siput gewang	Turbo
Teredo	tembilok	Kupang	Modiolus, Mytilus
Tridacna	siput kima	Kurita	Octopus
Gastropod:			
Cassidula	siput pinang	Lengkitang	Melania
Ellobium	belongkeng	Lokan	Cyrena
Cassis	siput kong	Puting puteri	Cardium
Conus	angkek	Rangar betul	Lambis
Galeodes	enam	Remis	Circe, Corbicula
Harpa	hapsel	Sela batu	Pholas
Lambis	rangar betul	Sinting	Placuna
Melania	lengkitang	Siput bingar	Melo
Melo	siput bingar	Siput keremah	Tridacna
Murex	ketem, song song	Siput kima	Oliva
Nerita	timba	Siput kong	Cassis
Oliva	siput keremah	Siput lolak	Trochus
Patella	siput sendok	Siput pinang	Cassidula
Cerithidea	belitong	Siput sendok	Patella
Tonna	gondang	Siput terompet	Triton
Triton	siput terompet	Sotong	Sepia
Trochus	siput lolak	Tembilok	Teredo
Turbo	kulai, siput gewang	Timba	Nerita
Voluta	kilah, siput kachar	Tiram, teritep	Ostrea
Cephalopod:			
Loligo	chomek-chomek	Togok	Chama
Octopus	kurita		
Sepia	sotong		

OTHER ANIMALS

Scientific (or English) Name	Malay Name.
Coelenterata. Jelly-fish	lambok; geronggong laut.
Coral	karang.
Crustacea. Scylla serrata	ketam batu.
Neptunus palagicus	ketam renjong.
Swimming crabs	kepiting.
Prawns	udang (also udang rebon, u. geragau, u. pepai, sanggugu.)
Echinodermata. Holothurian	gamat, beronok, trepang.
Reptiles. Turtles.	
Chelone	penyu, puin, sisek.
Dermochelys	belimbing, lembing, agil, akah.
Eretmochelys	sisek lilin, sisek karah, penyu karah.

Malay Name.	Scientific (or English) Name
agil	Dermochelys
akah	Dermochelys
belimbing	Dermochelys
beronok	Holothurian
gamat	Holothurian
geronggong laut	Jelly-fish
karang	Coral
kepiting	Swimming crab
ketam batu	Scylla serrata
ketam renjong	Neptunus pelagicus
lambok	Jelly-fish
penyu	Chelone
penyu karah	Eretmochelys
puin	Chelone
sanggugu	Prawns
sisek	Chelone
sisek lilin, sisek karah	Eretmochelys
trepang	Holothurian
udang (also u. rebon, u. geragau, u. pepai)	Prawns

Technological Terms

Boats and Gear

Ambai	Fixed stake using a fine meshed seine net about 30 feet long.
Ampang	Trap of ramie supported on poles on the beach (Ampang = dam)
Anchau (S)	A pukat with long hauling lines.
Anak Bedar	small Bedar used for ferrying in kualas.
Bedar	boat (see p. 63).
Belat	see blat
Bidang	section of the net
Bintoh	A small lift trap about 18" square for catching crabs. (Bintoh = to bend over).
Blat	various kinds of fish traps working in 3 fathoms of water or thereabouts at high tide.
B. Dudok	A fish trap with two leads.
B. Lengkong	Trap similar to the "Ampang", but with bamboo screens instead of ramie netting (lengkong = circulating or encircling).
Bubu	small portable underwater fish trap with 2 or 3 entrances.
Dogol	boat used on north Kelantan coast (see p. 64).
Empang (S)	coarse meshed stake net. See Ampang.
Gelam	a kind a caulking.
Gelibat	boat used on east coast (see p. 63).

Gombong	fine meshed net very similar to the "Ambai"
Gorit (S)	unbaited long line with unbarbed hooks.
Jala	cast net.
Jalorar	boat used on the Pahang coast (see p. 63).
Jalur	dug-out canoe used on rivers.
Jarin (S)	jaring q.v.
Jaring	gill net
J. Tamban	small anchored gill net for clupeoids.
J. Tenggiri	small surface drift gill net for Spanish mackerel (tenggiri).
J. Tenglam	modified J. Tenggiri, sunk below water surface (Tengam = tenggalam = to sink or be submerged).
J. Slangat	drift net for gizzard shad (slangat = shad).
Jermal	fish trap.
Jongkat (S)	trap; resembles a high triangular scoop net.
Jongkong	small dug-out. Also used for dinghy carried on larger fishing boats.
Juloh (S)	see Sungkor.
Juragan perahu	captain of a boat.
J. peraih	" " " carrier boat.
J. pukar	" " " net.
Juru selam	fishing expert.
Kelong	large fish trap.
Kepala	headman.
Kolek	usually a small or medium-sized fishing boat, but occasionally used for large ones.
K. Buatan Barat	see Perahu Buatan Barat (p. 62).
K. Gelibat	small boat (see p. 63).
K. Kueh	see kueh.
K. Lichang	medium-sized boat (see p. 62).
K. Ma' Siam	Dogol = small boat of Siamese design (see p. 64).
K. Malacca	local form of small canoe.
K. Pengayer	resembles K. Lichang.
Kotak	small Chinese sampan.
Kueh	small or medium-sized fishing boat used on east coast (see p. 63). A large number of distinctive epithets are added, referring mostly to the finish of the ends.
Koy	Fishing boat.
Layar	sail.
Lendong (S)	lesser form of Jermal.
Lepap	very small flat bottom boat.
Lichang	see K. Lichang or P. Kolek (p. 62).
Likung	joining sections of the net to form a circuit.
Medeh	rowing boat.
Moro Ami	Japanese coral reef net to catch sea bream.
Ngian (S)	purse net for shrimps chiefly.
Nong	triangular float of gill nets.
Paka (S)	see Sungkor.
Panau (S)	lift net used by Milanos.
Payang	see Pukat payang.
Pengail Perail	fishing boat.
Pengireh (S)	cone-shaped bamboo stow net.
Perahu	on east coast, any large fishing boat, or a decked cargo boat other than the Bedar.
Perahu buatan barat	a Kelantan boat, originating in Patani (see p. 62).
Perahu Kolek	alternative name for Kolek Lichang (p. 62).
Perahu payang	large boat used for the payang net (see p. 62).
Pintoh (S)	baited net for catching crabs. See Bintoh.
Pokchai	small dinghy (see p. 64) of Chinese origin.
Pompangs	Modification of the "Ambai" net.
Pukat	means, generally, a seine net.
P. Bawal	net used to catch "Bawal" (Stromateidae) (Pukat = a net; Bawal = a pomfret.).
P. Chang	see P. Petaram.
P. Dalam	gill net 120 fathoms long, 9 fathoms deep (Dalam = inside).

P. Duri	net for catching Duri (catfish).
P. Gonggong	net worked by hand in shallow water from a boat. (Gonggong = to seize by the jaws and carry).
P. Hanyut	drift net (Hanyut = to drift).
P. Kesot	Small seine net (kesot = to push forward on the ground to slide).
P. Kisa	Long seine net used in a shallow water (kisa = a small drag net).
P. Payang	Net similar to the "Pukat Gonggong"; but much larger.
P. Petaram	see P. Payang.
P. Sudu	purse net (sudu = a spoon).
P. Takur	see P. Bawal.
P. Talang	Drift net to catch fish called "Talang".
P. Tanggok	Same as "Pukat Bawal" (Tanggok = scooping basket for catching fish).
P. Tanggut	Purse type of net.
P. Tangkol	Lift net (Tangkol = large dip net used by fishermen located in a hut).
P. Tarek	Seine net worked on the beach (Tarek = to pull).
P. Tenggelam	smaller P. Hanyut — small submerged drift net.
P. Todak	net to catch small garfish (Todak = garfish).
P. Udang	prawn net.
Rantau (S)	Drift net.
Rawa	Push net.
Rawei	unbaited and unbarbed hooks used in long lines for capturing rays.
R. Umpan	long lines furnished with hooks and baited to catch fish. (Rawei = a line of fish hooks; Umpan = a bait).
Rumah Ikan	Compartment for fish lure.
Sadak (S)	see Sungkor.
Sampan	any Chinese fishing or ferrying boat; more specifically pattern as shown on p. 65 and Plate 16.
Sampan Kwak Tow	square-ended sampan (see p. 65).
Sekochi	small or medium-sized boat of European origin used on east coast (p. 63).
Slambo (S)	lesser form of lendong.
Sodok & (saup)	triangular net with long handle.
Sungkor	Push net (sungkor = to scoop up).
Tambak (S)	Small cone-shaped stow-nets.
Tangkol	Net submerged below the surface in shallow water.
Taut (S)	stake with hooks attached, driven into mud or sand at low water.
Tongkang	large sailing vessel of Chinese origin.
Towkay	chief, generally functions as agent or money lender.
Unjang	an anchored clump of coconut leaves marked by a float, which serves to attract fish which concentrate upstream from it.
U. ibu	small "
U. anak	large unjang

Fish Products and Marketing.

Anak perak	see hasil perak.
Aseh perak	see hasil perak.
Bagian	share.
B. awak	the crew's share.
B. dalam	share sometimes allotted to a net.
B. modal	share of capital supplier.
B. perahu	share of the ship owner.
B. peraih	" " " middleman.
B. pukat	" " " net owner.
Bagi tiga	to divide into 3 parts (tiga = three).
Balek modal	paying off.
Beli berutang	buying with a debt.
B. bilang	" on the number of fish.
B. borong	" an entire catch.
Beratang (berantam)	to club together to pay.

Blachan	shrimp paste.
Budu	pickled anchovies.
Chabut perut	gilling & gutting.
Daganang	fish buyer with pre-emptive rights.
Gadai	pawning.
Garam	salt.
Hasil perak	cash interest on loan.
Ikan	fish.
I. hidup	fresh fish.
I. kering	dried fish.
I. panggang	grilled fish.
I. singgang	spiced pickled fish.
I. talang	strip cured fish.
Makan asah	to take interest in instalments.
Makan laut	share in fresh fish for domestic needs of the fisherman.
Masok kongsi	entering a combine.
Mati molek	reasonable limit.
Menarang	a special appropriation made for paying out the net.
Modal	capital.
Pelara	salted fish paste.
Peraih bisikal	fish dealer using a bicycle.
darat	" " on shore.
hidup	" " selling live fish.
ibu	crew member who acts as middle man.
kandar	middle man using carrying pole.
kering	" " selling dried fish.
laut	" " at sea.
Pitis selalu	cash down.
Tawar	bargain.
Untong	profit.

Appendix iii.

The following is offered not as an exhaustive bibliography of available literature on Fisheries of Malaya, and cognate subjects, but as a list of the principal references by which a start could be made by anyone wishing to pursue these subjects further.

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Notes on the Plates

The 34 photographs illustrating this Bulletin are from negatives made by C. A. Gibson-Hill, of the Raffles Museum, Singapore. The following notes are given here to expand the information in the captions.

Cover A *Pérah* Koleh (Koleh Lichang) returning to Kuala Trengganu.

Frontispiece. A Koleh *Pengayer* (or New-Moon Boat) drawn up on the beach at Paka, in Trengganu. This is one of the most striking of the east coast boats, but it is not very suitable for work from open beaches. It is usually built to a length of 30-35 feet, with a beam of about 6 feet, and is employed with all the larger nets except the big *Pukat Payang*.

The following pictures are printed on 16 plates at the end of the book. The plates are numbered from 1-16, and the upper picture on each plate shown as "1", the lower as "2".

Plate 1, 1. A typical section of the west coast of Malaya, showing the belt of mangrove fringing the shore. (The view north from Tanjong Lemah, Negri Sembilan).

Plate 1, 2. The mouth of a small river on the east coast, showing the stretch of sandy beach broken by the mangrove belt of the estuary. A typical long, sandy beach is shown in the picture of Bachok, on the Kelantan coast (Plate 3, 1). (Looking south across the mouth of the Merchong River, south Pahang).

Plate 2, 1. A small fishing village on one of the islands in the straits south of Singapore. (Pulau Sudong).

Plate 2, 2. A typical fishing village on an estuary on the east coast. (Kampung Limbang, Chukai, Kemaman).

Plate 3, 1. An open beach village on the east coast. The houses lie back in the belt of coconut palms, and only the boats and racks for drying the nets are visible on the shore. (Bachok, Kelantan).

Plate 3, 2. A portion of the fishing village at Kuala Trengganu, built partly on the open beach, and partly fringing the backwater of the estuary. The large boats seen to the left of the picture are the big *Pérah* Payang.

Plate 4, 1. A Chinese west coast village built out on piles over the water. The site is partly sheltered from the Straits of Malacca by a small island. The boats, it will be noted, are mostly *Sampans*. (Kukup, south-west Johore).

Plate 4, 2. A Malay fishing village on a west coast estuary. The boat in the foreground is a crude version of the Kedah Coast Koleh, here used for carrying supplies. (Kampung Kuala Perlis, Perlis).

Plate 5, 1. A Chinese fishing *kelong* in the Strait of Singapore.

Plate 5, 2. A Chinese motor launch, with auxiliary sail, of the pattern used for collecting the fish from the *kelongs*.

Plate 6, 1. A Chinese fisherman operating a scoop net for prawns in shallow water off Singapore Island. He has raised the net to recover the catch from it. By him is the basket, supported on two bamboo floats, for the prawns.

Plate 6, 2. A Malay Bubu, made of plaited rotan. (Beserah, north Pahang).

Plate 7, 1. A Malay using a cast net (Jala) in shallow water off Singapore Island.

Plate 7, 2. Loading a seine net into a Përahu Koleh on the east coast of Malaya. (Paka, Trengganu).

Plate 8, 1. Operating a shore seine on the east coast of Malaya. The men are pulling on one end of the net, which has just been cast, preparatory to pulling it in towards the shore, while the boat goes out to pick up the distal portion of the curve. (Penarik, Trengganu).

Plate 8, 2. The end of the cast shown in the picture above. The men collecting the fish, mostly Ikan Bilis, from the belly of the net.

Plate 9, 1. Nets drying on the beach at Kemasik, Trengganu. This shows another typical east coast fishing village built on an open beach. The boats are mostly Përahu Koleh.

Plate 9, 2. Nets drying at Pangkor Island, off the coast of Perak. These are the large purse seine nets, used with a power boat, one of which can be seen close to the drying stands. The boat in the foreground is a Kedah Coast Koleh, the largest of the Malay-built fishing boats found on the west coast.

Plate 10, 1. The fish drying platform at Kuala Rompin, southern Pahang. This shows the method where the salted fish are laid out on mats made of thin strips of bamboo. These are removed when the fish are taken away, leaving only the bars on which they are supported. This method is generally employed when the fish have to be dried over the land.

Plate 10, 2. A fish drying platform at Beserah, northern Pahang. This is a much bigger, permanent structure, representing a more highly organized industry. The large platforms of this nature are generally built over the water, or over ground that is flooded periodically, so that the tide can remove the debris that falls through the slits in the platform.

Plate 11, 1. A Përahu Payang left dry by the tide on the beach in the estuary at Kuala Trengganu. This is the largest of the Malay boats, reaching a length of 40-45 feet; it is used almost entirely with the Pukat Payang.

Plate 11, 2. A Përahu Koleh or Koleh Lichang drawn up on an open beach at Dungun, Trengganu. The net laid partly over it to dry is a shore seine.

Plate 12, 1. A Jalor running into the estuary of the Pahang River. This is the fastest of the east coast boats, reaching a speed of 8-9 knots under favourable condition. The man standing holding a short line attached to the mast serves as live ballast, swinging out to windward to counterbalance when necessary.

Plate 12, 2. Two boats from the Kuala Trengganu fishing fleet running into the estuary. The one on the right is a Koleh Lichang, under full canvas. The one on the left is a large Bedar. The sail has been reefed partly, to allow the man in the small dinghy to come alongside to make a bid for the catch before it is landed.

Plate 13, 1. A small *Sekotchi* running into port. The man is beginning to reef the foreward sail, winding it round the boom in the manner customary in the Malayan fishing boats.

Plate 13, 2. A large *Pérah* *Buatan Barat* becalmed off the Kelantan coast. Both sails are set, giving some idea of the great amount of canvas carried by these boats, and the men are also helping her along by paddling.

Plate 14, 1. Two large *Gelibat* drawn up on the beach at Pontian, southern Pahang. The men are unloading their gear, while their wives divide out the catch.

Plate 14, 2. A small *Sekotchi* lying in the lagoon at Beserah, Pahang. This is the plainest and cheapest of the east coast boats, and for obvious reasons it has become very popular since the war, though the older Malays would still prefer something a little more ornamental.

Plate 15, 1. A group of Malacca *Koleks*, drawn up on the beach at Tanjong Kling, near Malacca town. The picture shows the small block at the bow, over which the anchor rope passes, and the peculiar winged decoration at the stern. These are small, lightly built boats, typical of those used for hand-line work on the west coast.

Plate 15, 2. A Straits *Kolek* (*Kolek Selat*) and a *Sampan Kwak Tow*, both Chinese built, in a carpenter's yard in Singapore.

Plate 16, 1. One of the large two-masted *Sampans* of the Malacca fishing fleet returning to port at dawn. These boats, which are manned by Chinese fishermen, usually put to sea at sundown, and return shortly after sunrise.

Plate 16, 2. A typical small fishing *Sampan* drawn up on the beach at Kampong Sungai Penang, on Penang Island. This boat, of Chinese origin, is extremely popular over the greater part of the west coast of our area.

PLATE I



The view north from Tanjong Lemah, Negri Sembilan



Looking south across the mouth of the Merchong River, south Pahang



The fishing village on Pulau Sudong, south of Singapore Island



Kampong Limbang, Chukai, southern Trengganu



The coast at Bachok, in Kelantan



A portioa of the fishing village at Kuala Trengganu

PLATE 4



The village of Kukup, south-western Johore



Kampong Kuala Perlis, Perlis, from across the river



A Chinese fishing stake in the Singapore Strait

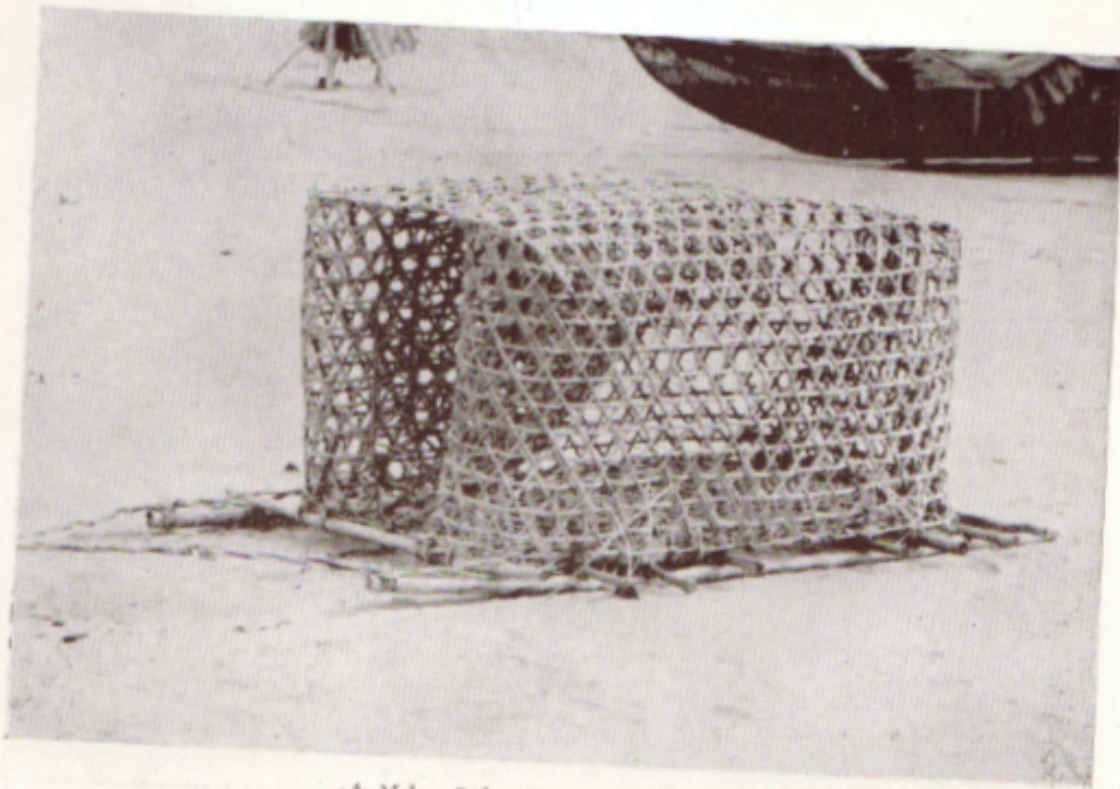


A Chinese motor-launch, with auxillary sail

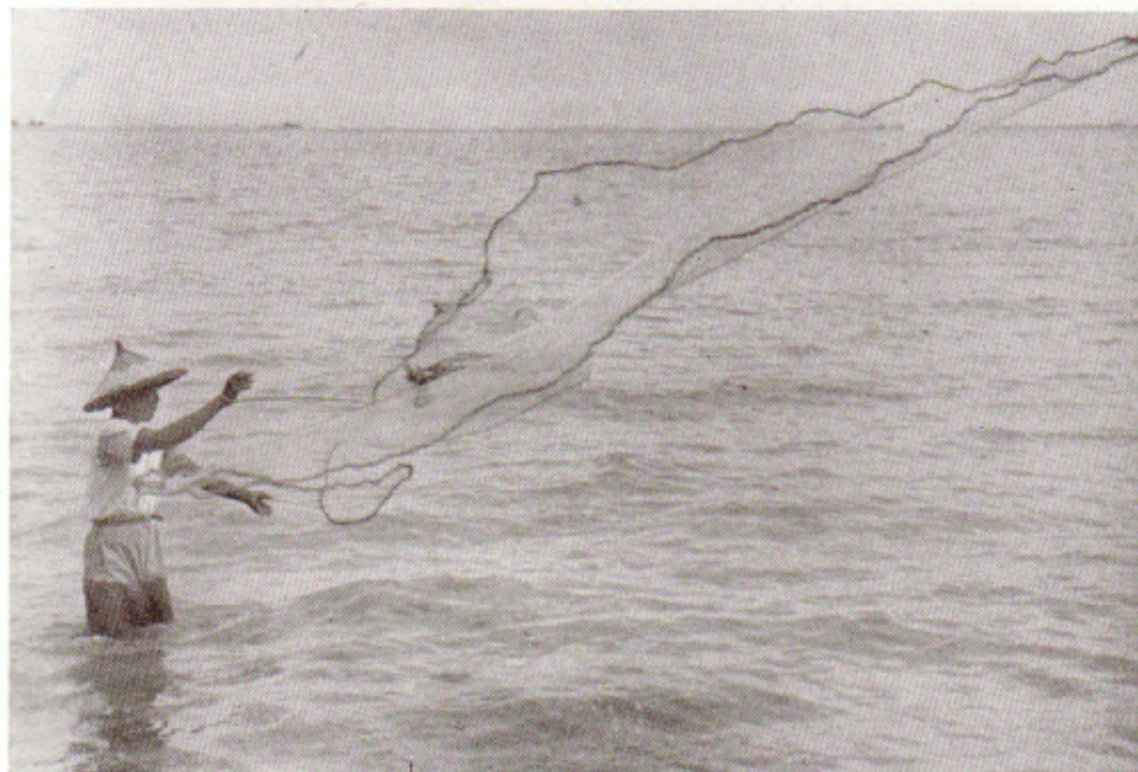
PLATE 6



A Chinese fisherman operating a scoop-net for prawns.



A Malay Babu; Bescrah, north Pahang



A Malay using a cast net



Loading a shore seine into a Përahu Koleh, Trengganu

PLATE 8



Operating a shore seine on the Trengganu coast



Taking up the catch from a shore seine



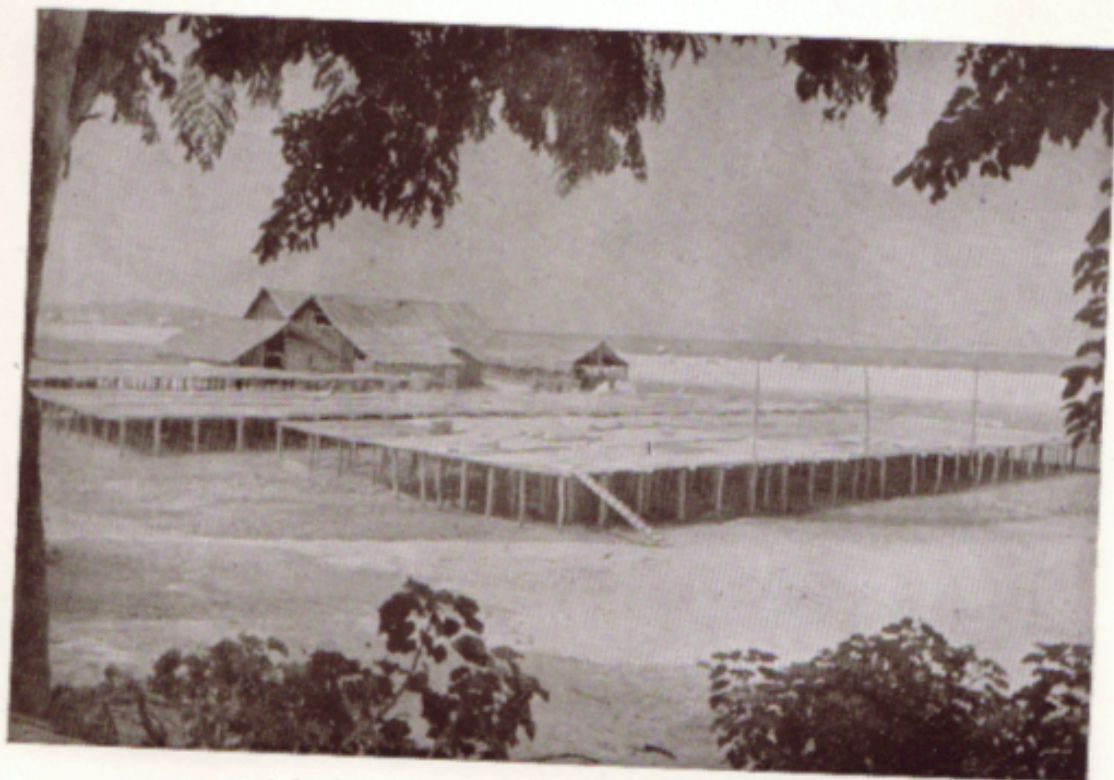
Mending nets on the beach at Kemasik, Trengganu



Net drying on Pangkor Island, off the coast of Perak



Fish-drying platforms at Kuala Rompin, Pahang



A large drying platform at Beserah, northern Pahang



A Përahu Payang on the beach at Kuala Trengganu

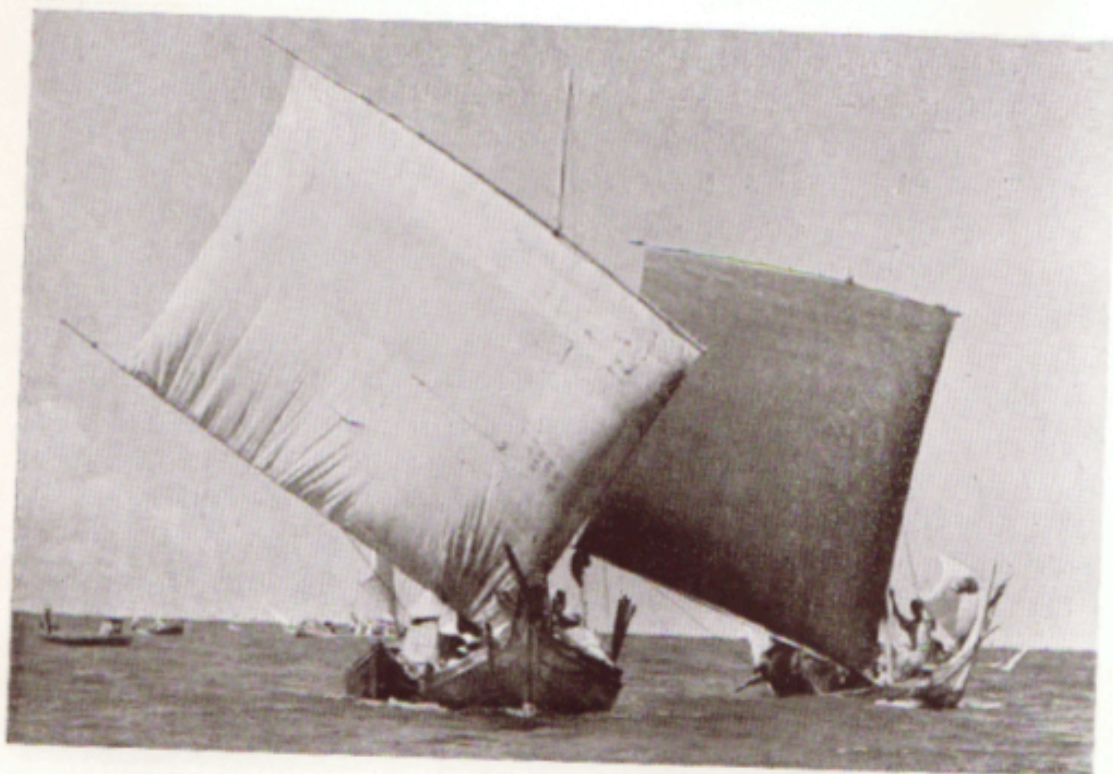


A Përahu Kolek (or Kolek Lichang) drawn up on the beach at Dungun, Trengganu

PLATE 12



A Jalorar entering the estuary of the Pahang River



A Bedar, on the left, and a Kolek Lichang running into Kuala Trengganu

PLATE 13



A small Sēkotchi under sail; one of the men is in the process of reefing the foresail



A Pērahu Buatan Barat becalmed off the Kelantan coast



Two large Gëlibat on the beach at Kampong Sungei Nangka, southern Pahang



A small Sëkotchi at Beserah, northern Pahang



The Malacca Koleh; Tanjong Kling, Malacca Territory



A Koleh Selat, on the left, and a Sampan Kwak Tow, in a builder's yard, Singapore



A large Sampan of the Malacca fishing fleet



A small Sampan on the beach at Kampong Sungai Penang, Penang Island